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GAS JOURNAL

LIGHT • HEAT • POWER • BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

VOL. CLXI No. 3113.] LONDON, JANUARY 10, 1923. [75TH YEAR. PRICE 1s.

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VOL. CLXI., No. 3113.] WEDNESDAY, JANUARY 10, 1923. [75TH YEAR.

EDITORIAL NOTES.

The Broken Gas-Main.

No one in the gas industry regards lightly, though accidentally caused, such a tragedy as that which occurred towards the end of December at Bethnal Green. Three lives were lost by, and a number of people were found suffering from the effects of, the inhalation of gas escaping from a broken main in the subsoil of the roadway, and which gas ran laterally under the concrete bed of the road into the neighbouring dwellings. The evidence clearly demonstrated that the Gas Light and Coke Company were in no wise to blame for what happened. The main had been in the road since 1880, and no trouble had occurred with it. Had there been any original negligence in the laying of the pipe—negligence sufficient to cause such a mishap—difficulty, it may be assumed, would have developed long since. But there has been none. The pipe, however, has been subjected to a combination of circumstances which eventuated in a fracture. It was proved conclusively that subsidence of the subsoil had occurred; there being a space of several inches between the concrete foundation of the road and the top of the subsoil. What caused this subsidence is not explained; and probably no one could definitely account for it. It might be conjectured that it was due to the operations at some time of other occupiers of the subsoil; but as to that no evidence was forthcoming. Then, again, the fracture of the main occurred in proximity to where it was resting on some brickwork. We do not suppose that originally the pipe was actually supported by the brickwork. More likely than not, in view of the time it had been laid, the pipe had sunk on to the brickwork. Then, in addition to these conditions, there is the changed character in the weight and speed of the vehicular traffic, and the vibrations caused by it. Having regard to the length of time the pipe had been in the subsoil, it is perfectly manifest from these considerations that the Company could not be charged with negligence in the matter.

Had these points been fully in the minds of the jury at the inquiry into the deaths of the three victims, they would not, we feel sure, have returned, in the first instance, a verdict as to the cause of death, with an addendum that "the "pipe was not laid with sufficient care." To us the life of the pipe alone is ample proof that it was primarily well and truly laid. Therefore, it was quite proper that the representation of the Company's Solicitor, and the enlightening supplementary evidence of their Chief Distributing Engineer (Mr. Stephen Lacey), should convince the jury that it was only an act of justice to eliminate the addendum, and to substitute the words that "the pipe, though laid in 1880 in "a manner involving no neglect at that date, fractured on "account of having been laid across some brickwork, which "caused unequal support and consequent strain as a result "of the subsidence of the subsoil." It was just an accident produced by unseen and so unsuspected conditions, which caused the pipe to be more than ordinarily susceptible to damage from the severities of modern traffic.

It is observed that the Coroner (Dr. Edwin Smith) suggested the possibility of introducing an ingredient into gas which would give rise to an irritating cough, and so, in the event of there being an escape of gas, awaken people who were asleep. Mr. W. J. A. Butterfield, one of the Gas Referees, disposed of such an idea as impracticable, and as being worse than any danger that there is in gas. Gas has a strong distinctive smell; and the fact that in this case the smell gave warning to some of the residents is a sufficient indication that it should have been a warning to others. But unfortunately it was not. Of course, the old question of carbon monoxide has been raised. Some of the newspapers have become quite obsessed by this "The Times" is one of those papers; and on every occasion the subject is raised in that paper, there is unconscious disclosure of the fact that it knows very little about it. It states that when gas was first distributed as a domestic illuminant, it contained only traces of carbon monoxide; and then the introduction of "iron" retorts raised the percentage to about six. For the information of the learned "Times," may we point out that when gas was first distributed and contained only "traces" of carbon monoxide, it was produced in iron retorts; and the successors of iron retorts were fireclay ones. Thus our morning contemporary loftily, but ignorantly, tries to inform the public, and misleads them. It also states that water gas contains approximately "46" p.ct. of carbon monoxide. That is putting it high for blue water gas; and the figure for carburetted water gas is nothing like it. Water gas is not distributed neat in this country; it is in some places in America. In admixture with coal gas, as in the case of the Gas Light and Coke Company, the gas as distributed contains much less than the 20 p.ct. that Dr. Haldane is of opinion should be the limit. But "The Times" prefers to emphasize the heavy carbon monoxide content of water gas without troubling to give the real facts from the public point of view. That probably appeals to our contemporary as much more impressive; and it is quite in accord with the ways of sensation mongers. "The Times" has changed its category.

The Uneconomy of Heat Losses.

ALL are agreed that heat losses should be reduced to the lowest possible amount; but comparatively few seem to trouble much about them. Probably this is due to the fact that the majority of those who should be concerned do not appreciate the magnitude of heat losses, and what they actually represent in money. There was some guide to enlightenment in the short, but highly practical and informative, paper that Mr. W. Newton Booth recently contributed to the proceedings of the London and Southern Junior Gas Association [see "JOURNAL" for Dec. 27, p. 798]. In this he points out that, for rough calculations, it may be taken that a square foot of any heated surface will, in still air, lose 3 B.Th.U. per hour for each degree difference in temperature between it and the air. If there is a draught, or the surface is exposed or wet, the loss will be vastly increased. We suggest that even for "rough" calculations it would be very misleading to take only 3 B.Th.U., except under certain temperature conditions; and that this is so is shown by the diagram accompanying the paper. The greater the difference between the temperatures of the surface and of the air, the greater will be the rate of heat loss. For instance, the diagram shows that, with a temperature difference of 500°, the loss would be 5 B.Th.U. per square foot per hour per degree of temperature difference. With such a difference, the loss would be 5 B.Th.U. × 500° difference = 2500 B.Th.U. per hour per square foot. Therefore, in 100 hours, the loss per square foot would be 250,000 B.Th.U., which would be equal to 21 lbs. of solid fuel of a potential heat value of 12,000 B.Th.U. per lb., or to 2½ therms if gas is the heating agent. Multiply this by the total square feet of surface, and the number of hours' use in a year, and the uneconomy of the heat losses will exceed anything that may have been imagined, if not previously investigated. If we take a domestic gas-heated appliance with 20 sq. ft. of ex-

posed surface, and assume a difference in temperature of only 200° between the exposed surface and the air, and a loss of 3 B.Th.U. per hour for each degree of temperature difference, the loss would be $200 \times 3 \times 20 = 12{,}000$ B.Th.U. per hour. Assuming 700 hours' use a year, the loss would be 84 therms, which at 9d. would be £3 3s. One can see from this, however rough the calculation, how great must be the expenditure on surface heat losses in industry (including gas manufacture), and in all domestic appliances which require heat for their operation.

The fact shows that, the cost of heat loss being cumulative, a fairly considerable sum could be profitably spent on securing a diminution, though always there must be consideration of the relation of cost to heat saving in order to realize a balance on the profitable side. This applies in all directions where heat is used. Mr. Booth discusses the question of heat-insulating materials. Methods of lagging have each their advocates; but more often than not, the latter have little scientific data available to support their advocacy. The thickness of lagging and the thermal conductivity of the material, are the two factors governing the heat losses from any covered surface. The conductivity of the material is largely, if not wholly, a matter of physical properties. Mr. Booth submits, and there is no doubt he is largely attracted by the insulating value of, plastic magnesia, which consists of 15 p.ct. of asbestos fibre as a binder, mixed with a very light form of magnesium carbonate, with a small amount of adhesive material to make it cohere. He testifies that the plastic magnesia has a conductivity less than three times that of air itself, and is a most effective insulator. Here the questions of cost and life come in. Mr. Booth reckons that it may be taken as three years before this form of lagging requires renewal. A cost of 1s. 3d. per square foot may be rather high in comparison with other materials; but if on a steam system the expenditure of the 1s. 3d. would save heat of the value of 3s. 6d. per annum for three years, then it is a good business proposition. It is the net saving by the use of different materials that must be the test applied to the question of the relative effective working lives of the materials. This matter of heat-insulating materials is one that requires to be studied along scientific lines in order to get to the whole truth—scientific lines comprehending efficiencies, life, costs, and savings. One result of this would be to clear away the rubbish which is sometimes applied seriously and confidently, but which is next to useless.

Standardization of Gas-Coal Testing.

WHY cannot a definite specification be drawn up for the testing of coals to be carbonized for gas making? There seems to be no insuperable difficulty in the way of doing this; the difficulty would probably arise in its application in some gas-works. However, the question was raised by Mr. W. Grogono, of the Gas Light and Coke Company, in the discussion of the paper on "Coal Testing" published last week [p. 35], and read before the London and Southern Junior Association by Mr. William Bell, of Reading. The variety of the methods of coal sampling and testing on a gas-works is really remarkable—one might almost say ridiculous—and therefore incomparability of results reigns supreme. This is a distinct pity from the point of view of the interests of the gas industry in connection with the material for which the largest amount of money is spent. A standard coal test (so far as the conditions could be standardized in view of the fact that different coals require different temperatures for maximum production) would, if generally practised, yield results which, if assembled, would soon supply the whole industry with a desideratum—that is, information as to the capabilities of representative gas-making coals, though even then qualities vary so considerably from the same pit, and from the same seam, that continuous reliability could not be placed upon the information. This is why it does not do merely to think that the coal that is coming in is the same, year in year out. There is no guarantee that it is. Therefore, there must be fairly regular works testing. But Mr. E. W. L. Nicol would like to see testing at the pithead before coal purchases are made. This would be very proper, if practicable. It could only be done by co-operation, and at a central place in each area. Otherwise there would be a good many testing stations to equip and support. This is a subject that has been raised on previous occasions—particularly since the South Metropolitan Company started testing coal at Newcastle. But though vague references are made to pithead testing and co-operative action, and it is agreed that it would be a very good thing, no one comes forward with a practical scheme, or even one in more or less crude form, that could be adopted as a basis for consideration and discussion. However, Mr. Bell managed in short compass to introduce in his paper a great many matters relating to coal testing; but interest generally centred round laboratory methods, small test plant (with an iron retort, low temperatures, and results quite out of harmony with high-temperature operations), and working-scale tests. The last-named are very properly the most favoured ones for actual guidance as to what may be expected under normal working conditions. The laboratory test, carbonizing 2·24 lbs. of coal may give information that is useful, but it is not information that can tell us what will happen under working conditions. We hope that the subject of a standard gas-coal test will not be overlooked by the Institution of Gas Engineers. In devising one, the Institution might perhaps obtain the collaboration of the Board of Fuel Research.

Breeze and Boiler Fuel Economy.

THIS week we publish the paper that Mr. T. W. Andrews, of the South Metropolitan Gas Company, read a short time ago before the London and Southern District Junior Gas Association, on the subject of "Fuel Economy on Gas-Works Boilers." The economical use of fuel under steam-boilers is not a strong feature in the operations of some gas-works, though this must not be taken as a charge of neglect in the case of all, because it would not be true. One reason for the neglect is that coke breeze was at one time a despised product and a drug; and the boiler furnaces were regarded as a good means of getting rid of as much of the surplus breeze as possible. Uneconomical fuel use and low boiler efficiency went together; and what has been, largely continues. But Mr. Andrews, who is a master in the art of using low-grade fuels under boilers, and getting good duties from them, so producing economy where uneconomy previously existed, holds that gas undertakings cannot longer, in view of its proved usefulness, allow breeze to be regarded as a waste fuel; and he goes further in saying that the problem of what shall be done with surplus breeze no longer exists. Mr. E. W. L. Nicol, of the London Coke Committee, in the discussion, declared that every pound of breeze that is saved as a result of Mr. Andrews' paper can be readily sold outside the gas-works at a good price. We remember, too, that some years ago Mr. G. M. Gill, who is also an authority on the subject, stated that he saw no reason why breeze, having regard to its thermal value, should be disposed of for steam-raising purposes at a price much below that of coke, as was then the practice of many gas undertakings.

Thus it is that gas-works should themselves become models of steam-raising efficiency by the use of breeze as the furnace fuel. But there is the allegation by Mr. Andrews that, while it is generally known that boiler plants as a whole are inefficient, very little information comes to light as to how inefficient they really are. This is a condition of things that must be corrected in the interests of works' economy, and in those of gas undertakings as vendors of a good boiler fuel, which factory owners are now finding possesses virtues for the purpose of steam-raising superior to some of the bituminous slacks. It will be noted in this connection that Mr. Andrews states that it is quite possible, under normal working conditions, to obtain an equivalent evaporation of 6 lbs. per lb. of fuel from and at 212° Fahr. with coke breeze of 9500 B.Th.U. per lb. Much was said in the paper and during its consideration as to the screening-out of the fine portion of the breeze. It is a very general belief that by doing this the ash content of the breeze is largely reduced, resulting in a better fuel. But this belief is based on pure hypothesis, which chemical analysis and experiment between them are fast destroying. A table in the paper shows that the fines and the dust have nothing whatever of which to be ashamed, compared with the other components of breeze—at any rate, no advantage is gained of a sufficient order to justify the cost of screening.

The paper is constituted in major part of advice as to how to secure the best efficiencies using coke breeze, though Mr. Nicol apparently does not think that Mr. Andrews claimed all he might have done in respect of the efficiency of gas-works boilers. But high efficiencies cannot be claimed as the rule except in the case of gas-works so staffed that

adequate supervision can be given to this part of the plant. However, the author may be taken as a mentor in respect of conditions and control with the view to obtaining the highest evaporating duty and efficiencies using coke breeze as the fuel. We will not traverse the information supplied in the paper in these respects; but just two points may be emphasized. The Lancashire boiler is given precedence in the matter of excellent steaming qualities, and suitability for inferior class fuels. The author cannot speak so highly, for reasons advanced, of the Galloway boiler; and where small type water-tube boilers are used, he would eliminate low-grade fuels altogether. In this case, higher efficiency, and an increased duty approximately to 75 p.ct., would result from the use of graded coke with this class of boiler under working conditions. The other point is the importance of having furnace stokers with brains which they know how to use. In this connection, Mr. Andrews told of his experiences in the training of stokers in firing boilers with coke breeze, which training is the first step in fuel economy. During this work, the average efficiency result from the first test with each man gave a figure of 53 p.ct.; the average for the last shift was 65 p.ct.—an all-round improvement of 12 p.ct. A 12 p.ct. improvement in efficiency is a big thing, seeing that, if the men maintain the character of their work, the improvement is cumulative, and means something substantial at the end of (say) twelve months. Throughout, the paper is a very practical one; and in these days, when men are out to make reclamation from what has been waste, it is very valuable.

What Smoke Fog Is.

ANYONE who wants to know the why and the wherefore of smoke fogs, and why sometimes we get them and sometimes do not, though in certain seasons of the year domestic chimneys are constantly sending forth smoke, cannot do better than obtain information from Dr. J. S. Owens, than whom there is, upon this particular matter, no greater authority in the country. He is the author of the second article in "The World's Work" of the series dealing with smoke abatement; and the title of his contribution is that which appears at the top of this article. It is necessary for those who are concerned in the amelioration of the miasmal conditions of our atmosphere to learn as much as possible about their constitution and vagarious and noxious behaviour, in order to emphasize the importance of minimizing, or altogether doing away with, the smoke itself. That is the only cure; and that is the cure the gas industry are, with progressively favourable success, working assiduously to apply. Dr. Owens does not in this particular article tell us anything as to the harmful and destructive operations of smoke. He deals solely with the density and distribution of smoke clouds or smoke fogs, and gives information as to the reasons why—though practically the same quantity of smoke is being poured into the atmosphere at a given season of the year, though the material for smoke fog is always present in the atmosphere—some days we have to suffer darkness and other unpleasantness, while other days there is comparative freedom from such ills.

This is a very interesting study; and it shows that in the problem the only humanly controllable factor is the smoke itself. All the other contributory causes to density and diffusion of smoke fog are natural forces. At any rate, Dr. Owens thinks it is very probable that investigations now being carried out will show that the connection between smoke fogs and ordinary fogs will be found rather in the meteorological conditions than in the materials of which they are composed. This suggests, although it is not an agreeable thing to contemplate, that, were it not for the changeableness of those conditions, we might be living in perpetual darkness and baneful surroundings owing to the burning in a crude way of bituminous coal for heating purposes. Nature could never have intended that this mineral provision should be employed in such a fashion as to be detrimental to her other provisions of light and pure atmosphere, and therefore noxious to human life, activities, and pleasure. There are really two forces that contribute to the density or diffusion of smoke fogs. One is the wind, and the other the variation of temperatures vertically. As to the wind, its velocity determines the extent of the distribution of smoke in a given area. The greater the velocity, the thinner the smoke fog becomes; the lower the velocity, the more concentrated the fog. Then as to the effect of atmospheric temperature. Smoke rises from chimneys into colder and colder air. If for any reason there is overhead a layer of warm air, the smoke can penetrate no farther. Wherever the layer of warmer air is, the smoke will hang there, providing there is no wind. If, on the other hand, the layer of warm air is low (say, at housetop level), the smoke fog will remain right down in the streets. With such considerations in mind, Dr. Owens submits that a smoke fog may exist when there is no ordinary fog or mist at all.

One other interesting point from the article. Dr. Owens' extensive researches have produced the information that the proportion of smoke issuing from domestic chimneys to that from factory chimneys is in London approximately 2¼ to 1. This agrees fairly closely with the recently submitted ratio of four-fifths to one-fifth of the total. Confirmatory evidence is found by comparative experimental work on week days and on Sundays, and at different times of the day. There is proof, too, of an increasing impurity from 6 a.m. to 11 a.m.—during the lighting-up period, and while crude coal is being largely burned; the air previously being pure. A couple of charts are given; and these with the text point beyond dispute to the responsibility of the domestic fire for the greater part of the impurity, and so of the troubles to which from this cause humanity is subjected. To the domestic chimney then, the men of the gas industry and architects should devote a good part of their energies; for in this direction they can render inestimable service to the human race now and in all time ahead.

Low-Priced Therms.

Our "Correspondence" columns to-day show that two gas undertakings claim to have beaten the Bath charge of 5¼d. per therm. But the Bath Company and their Engineer will not feel (they have no cause to be) disconcerted over this. Middlesbrough is one of the undertakings; and by it coke-oven gas is largely supplied. The net price there is equivalent to 5·45d. per therm, or 0·05d. below the Bath price. Widnes is the other undertaking. The domestic consumers there are supplied at 2s. 3d. per 1000 c.ft. of 480 B.Th.U. gas, which works-out to 5·625d. per therm. But if the industrial consumers (motive power and furnace users) are all reckoned in with the domestic consumption, the differential prices charged bring down the average to 1s. 11¼d. per 1000 c.ft., or 4·84d. per therm.

Therm-cum-Cubic Feet Accounts.

The letter published in our "Correspondence" columns last week from Mr. Ralph Halkett, General Manager of the Sheffield Gas Company, and the copies of the gas accounts which he enclosed for our inspection, show us that, from the very first quarter the Company were working under the Gas Regulation Act, it was appreciated by the administration that it would be advisable to render the accounts in cubic feet and therms. They obtained their Order in March, 1921, and the June account that year was made up in this form:

State of meter....June	1921..	00
Deduct previous state as taken for the March Account		00
Gas consumed, cubic feet		00
Equals	Therms at d.....	

There follow the items as to rent of meter, stoves, and fires, together with maintenance charges. On the reverse side of the account, full explanation is given as to how to read a meter, and how to make the conversion to therms. The same information has been continued since, with the addition of the announcement: "The Gas Referees prescribe that the results of the tests made by each officially appointed Gas Examiner shall be made available for the use of the public in the following manner: 'A copy of his report for the preceding quarter, as forwarded to the Local Authority by whom he is appointed, shall be exhibited by the Company in each of the Company's offices and showrooms, and shall be carried by each of the Company's collectors for production to any consumer on demand.'" Nothing could be clearer than the information supplied to their customers by the Sheffield Company.

Another Illustration.

In this practice they do not stand alone. Another good form is that of the Maidstone Gas Company. We have a copy

of the account that they have issued since they came under the therm basis. The items under discussion are rendered as follows:

Index of meter—Dec. 31, 1922 .. :
Sept. 30, 1922 .. :
Consumed .. :
..... cubic feet = Therms at 11·8d. per therm .....
Equivalent to about 4s. 9½d. per 1000 c.ft.

It will be seen that in this form the Maidstone Company go one better than Sheffield by stating the equivalent price per 1000 c.ft. The Bristol form of account has been given much prominence, owing to its production as an example at the therm inquiry. The impression has got abroad that the forms of account adopted by other gas companies are unintelligible, and only tend to confusion in the minds of the consumers. Our information shows that intelligent anticipation of the needs of the public in this regard has not been of such a limited character as some people have supposed to be the case.

Mantle Imports.

In a review of the monazite and mantle trade in 1921, Mr. Sydney J. Johnstone, B.Sc., gives a table showing the imports of gas-mantles into Great Britain in 1920 and 1921. The figures are illuminating regarding the operations of the German manufacturers, in the matters both of price and dumping. In 1920, Germany sent into this country 21,359 gross of mantles of a value of £51,710, which we work-out at £2 8s. 8d. per gross. In 1921, 63,756 gross reached this country from Germany; the value being £111,917, averaging £1 15s. 1d. per gross. In other words, the German imported product increased in quantity threefold, and the total value more than twice. Noteworthy, between the two years, is the shrinkage of imports from Holland and Belgium. There has long been a grave suspicion that the German manufacturers have been operating fairly extensively through those two countries; and they may do so again. In 1920, from the Netherlands 19,949 gross came; in 1921, 11,015 gross—the respective values being £41,409 and £21,087. Our imports from Belgium were 21,663 gross in 1920, and 16,301 gross in 1921—the respective values being £54,225 and £37,182. From other sources came quantities which made the total imports in 1920 78,357 gross, and in 1921 111,536 gross—the respective values being £117,216 and £204,832. It will be seen from these figures how largely Germany has succeeded in encroaching on the British mantle industry; and the 33⅓ p.ct. duty is not going to stop them. They have fixed ideas as to what they want to achieve so far as the British mantle industry is concerned; and they do not intend to be defeated from realizing their object, if the British public will support them. In view of the position of gas lighting at the beginning of the war owing to the large dependence of this country on Germany for mantles, it is imperative that the mantle industry here should be well maintained. Some people, however, are disinclined to look forward in this matter.

A New Gas Coal Report.

With the beginning of this year, we have secured a correspondent associated with the coal market on the North-East Coast, who will be contributing a weekly report. This will be found towards the end of the "Miscellaneous News" section of the "JOURNAL." This week, he discusses the prospects as viewed from his particular area. But it must not be assumed that all he says will apply with equal force to other coal areas and markets. Partially, it will do so, because the conditions that affect such an important market as the one with which he is personally identified have an influence much farther afield. We have seen this lately in connection with the spreading demands for gas coals for export. In all areas just now, the colliery owners regard the gas coal market as good; and they are not viewing prospects with any dissatisfaction. Everywhere the demands from and supplies to gas-works are causing good activity.

Renewals and Extensions.

Recently it has been submitted in these columns that now is probably as good a time as will exist for some period ahead for undertaking plant renewal and extension work. The same feeling appears to prevail in the United States, judging from a letter received last week from one of the progressive contracting firms there. It says: "Conditions in the gas industry are undergoing a rapid and radical transformation. This is plainly indicated by the almost unprecedented number of inquiries for estimates of repairs and extensions which are coming into our office. Material and labour costs have now settled down to a fairly stable basis. Price changes from now on will undoubtedly trend upward rather than downward. No longer does the gas man feel that, by putting off repairs or extensions, he will be able to save a lot of money. Instead, he is more apt to look at the matter this way: 'By delaying necessary work to-day, I will probably suffer to-morrow from inefficient production, depreciating service, and dissatisfaction on the part of my customers—the public. In the end, I shall lose money by not being prepared, and by having to pay more for the work.'"

The Agricultural Problem.

We learn from Mr. D. B. Toye, the Secretary to the Tribunal appointed by the Government to investigate the agricultural problem, that the proceedings will be conducted in private. Thus there will be no information available, as progress is made with the inquiry, concerning any evidence submitted regarding artificial fertilizers. We shall have to wait until the Committee issue their report to ascertain whether or not this important matter has had any prominent place in the investigation. It cannot be bypassed if the inquiry is to be a complete one.

The N.U.R. and the Transport Workers.

A short time ago, reference was made in these columns to a proposal that the National Union of Railwaymen and the National Transport Workers' Federation should amalgamate their forces. A return has just been issued which discloses a majority of forty-six branches and 11,435 members of the N.U.R. against the proposal for affiliation with the Transport Workers.

MONAZITE AND THE MANTLE TRADE IN 1921.

In his review of the position of monazite, which appears in "The Mineral Industry, 1921" (issued by the M'Graw Hill Book Company of New York), Mr. Sydney J. Johnstone, B.Sc. (Lond.), A.I.C., again includes an interesting section dealing with Great Britain. He says that during the year 1921 the thorium-nitrate and incandescent mantle trades of Great Britain were in a very unsettled condition owing to German competition and uncertainty as to what would be the outcome of several appeals pending under the Safeguarding of Industries Act.

Imports of Incandescent Gas-Mantles into Great Britain.

Country Whence Consigned.	1920.		1921.	
	Quantity. Gross.	Value.	Quantity. Gross.	Value.
		£		£
Germany	21,359	51,710	63,756	111,917
Netherlands . . .	19,949	41,409	11,085	21,087
Belgium	21,663	54,225	16,301	37,182
France	1,370	3,579	330	447
Switzerland . . .	3,962	8,672	5,619	12,959
Italy	8,769	13,817	8,175	11,625
Austria	559	1,267	2,258	2,218
United States. . .	283	1,663	717	2,586
Other countries . .	445	874	113	234
Totals	78,357	117,216	111,536	204,832

In 1921 Great Britain exported 21,013 gross of incandescent mantles, valued at £73,720, as compared with 51,737 gross, valued at £171,147, in 1920. During the year 8575 gross were exported to Australia, 4668 gross to India, 3146 gross to New Zealand, and 1066 gross to Argentina. Whereas the quantity of monazite sand imported during 1921 was about the same as in 1920, there was a large increase in the number of incandescent mantles imported. A decrease occurred in the amount of thorium nitrate imported; but it is interesting to note that 10,573 lbs. of the British-made salt was exported to the United States.

Evidence given in 1922 before the Committee appointed to hear complaints under Part II. of the Safeguarding of Industries Act showed that of the four factories in the United Kingdom which had previously made thorium nitrate, three were closed and one was working only half-time. Two of the works producing magnesia rings for inverted mantles were closed, and the other was producing only one-third of its normal output; while the two factories making ramie yarn were only working half-time.

The sales in Great Britain of British-made incandescent mantles amounted, in 1921, to about 280,000 gross, as compared with about 444,000 gross sold in 1920.

Yorkshire Junior Gas Association.—The next meeting of the Association will be held at Wakefield on Jan. 27, and not on Jan. 20, as previously announced.

PERSONAL.

Mr. SAMUEL B. CHANDLER is to be congratulated upon having been appointed Distribution Superintendent of the Tottenham District Light, Heat, and Power Company. He was formerly in the Distribution Department of the South Metropolitan Gas Company, and is at present in charge of the Sales Department of the South Suburban Gas Company, with which he has been connected for nearly ten years. Mr. Chandler, who was educated at the City of London School, is a member of the Institution of Gas Engineers, an associate member of the Institution of Mechanical Engineers, a member of the Southern Association of Gas Engineers and Managers, and was President of the London and Southern District Junior Gas Association from 1915-16 to 1919-20—doing a great deal of good work in this capacity during a very difficult period.

Mr. G. M. GILL, who has commenced practice as a Consulting Engineer, informs us that, after Jan. 29, his address will be 119, Victoria Street, Westminster, S.W. 1.

Owing to failing health, Mr. JOHN BRADLEY, Gas Manager at Athlone, has resigned. He had been 34½ years in the service of the Urban Council.

His many friends in the industry will be pleased to learn that Mr. F. J. GOULD, the Chairman of the Bland Light Syndicate, Ltd., is recovering from his serious illness, and expects to be back in business this month.

Mr. W. A. SYCAMORE has been appointed London Manager of the Keighley Gas and Oil Engine Company, Ltd., of Imperial Works, Keighley, and Albion House, No. 59, New Oxford Street, W.C. 1, in succession to Mr. H. S. Aspinall, who has resigned his position with the Company. Mr. Sycamore was formerly with the British Westinghouse Electrical and Manufacturing Company.

Mr. NORMAN S. SMITH, B.Sc. (Leeds), Gas Engineering, has been appointed to the position of junior assistant on the editorial staff of the "JOURNAL." Mr. Smith received his school training at the Wakefield Grammar School; and after brief periods of service at Crigglestone Coke-Ovens and at the ammonia works of Messrs. Brotherton & Co., went on active service in 1917, becoming a second lieutenant in the Royal Air Force and a pilot in 1918. At the end of the war, Mr. Smith entered the Leeds University for the three years' course leading to the B.Sc. degree in Gas Engineering. The course included chemistry, physics, mathematics, and applied mechanics up to intermediate standard, chemistry, mechanical and electrical engineering to a higher standard; and finally the more professional subjects of fuel and gas engineering, which constitute the main part of the later training, and in which the final examination is held. Mr. Smith, Prof. Cobb informs us, passed an excellent examination for the B.Sc. degree. He has had vacation works' experience at the Horbury Junction Iron-Works, and has been an assistant to Mr. A. E. Mottram, at the Ossett Gas-Works.

OBITUARY.

Deep sympathy is extended to Mr. F. W. CROSS, Engineer and Manager of the Lea Bridge District Gas Company, who has had the misfortune to lose his wife. Mrs. Alice Cross peacefully passed away last Wednesday, the 3rd inst. Mrs. Cross had been an invalid for some time; but her death was unexpected, and came as a great blow to her husband. A resident in Walthamstow for many years, she formerly took an active part in church and charitable work. She had one son—Mr. D. Cleave Cross, who is Assistant Manager to the Lea Bridge Gas Company—and two daughters.

The death occurred on Dec. 28, from bronchial pneumonia and heart trouble, of Mr. F. JOURNET, who had been for no less than 56 years with Messrs. John Russell & Co., Ltd., tube manufacturers. Mr. Journet, who was 70 years of age, spent 10 years in the office of the firm at Soho, and was for 46 years "on the road," during which time he became well known to gas managers in various parts of the country. He lived only two months to enjoy a well-earned retirement.

Grease Seal for Exhauster Stuffing-Boxes.—The Detroit City Gas Company have found specially successful on low-pressure exhausters in coal-gas service the following grease seal for stuffing-boxes. A box of 2-in. planks 6 in. high is built-up to surround the entire stuffing-box; the bottom edges being trimmed to conform with the shape of the bearing caps, and a ½-in. felt gasket being placed along the edge to make a tight fit. This device is held-down solidly with metal straps, and filled to the top with No. 2 machinery grease, the stuffing-box being covered by several inches of grease. This scheme was first tried on a street pressure unit operating at a pressure of up to 5 lbs. per sq. in. The Company find it necessary to renew with fresh grease about once per month, because the grease becomes too liquid, allowing the gas to travel along the shaft to the oil-cup openings. Previously these stuffing-boxes leaked continually. The grease seal is useful on exhausters where the bearings have worn down slightly, so that the gland space is a trifle eccentric, making the packing tight at the bottom and loose at the top. It will keep the stuffing-boxes tight until it is advisable to renew the bearings.

ELECTRICITY SUPPLY MEMORANDA.

THE Electricity Commissioners have issued their second annual report—covering the year to March 31 last. It is an illuminating document; and there is a good deal of the human spirit about it.

Development of the Electricity Industry.

It sympathizes with the electricity supply industry over its retardation through general industrial depression; it pats it on the back over its importance as a great power supplier in industry; it gives encouragement by predicting an expansion of demand during the next few years, which suggests imagination of a very high order; and it seeks to be helpful to unoccupied areas and non-statutory concerns. The report shows that there are 212 electricity undertakings owned by companies; 315 in the possession of municipal authorities; and seven are the property of private persons—making 534 in all. Having commented upon the adverse influence upon the industry of industrial depression and of the uncertainty that dogged the movements of the supplementary Electricity Supply Bill, the Commissioners mention that the plant extensions sanctioned during the year only amounted to 174,000 KW., as compared with 697,000 KW. in the previous fourteen months. They look for great developments in the electricity industry with the resumption of normal manufacturing activities. This is exemplified by the following tabulated statement, which only refers to eight provisionally determined districts:

	1920-21.	1926. (Estimate.)	1931. (Estimate.)
Maximum Demand (KW.). .	833,226 ..	1,542,435 ..	2,207,890
Units (Millions)	1,923 ..	3,799 ..	5,624

Statistics regarding output have been compiled from returns furnished by undertakings generating electricity. These, though not quite complete, are sufficiently approximate to be representative. They show that the total units generated by electricity supply undertakings amount to nearly 4000 millions; and by railway, tramway, and other undertakers, to nearly 1000 millions. The consumption of materials for this output is given as 6,475,531 tons of coal and coke, and 145,541 tons of oil fuel.

A Busy Year.

The Commissioners have had a busy year through the multiphase character of their work; and particularly in connection with inquiries and decisions regarding the new schemes of distribution and generation. Fifteen electricity districts have been delimited; and out of these one scheme has been practically dropped (Lower Severn area). Ten schemes are in various stages of incompletion, leaving four others practically completed in outline and ready for embodiment in a draft Order. Of the latter, since the report, three draft Orders have been issued—viz., North Wales, South-West Midlands (Birmingham and Worcestershire area), and South-East Lancashire (Manchester district). The Commissioners again contradict the cherished idea of some newspapers that this work of theirs represents a national scheme which is going to bring electricity supply to the doors of cottagers in all towns and remote villages. At the same time, unoccupied areas are not being overlooked by the Commissioners, who are going to provide that every joint authority shall submit, within a given time, proposals for supply in such areas where there is reasonable prospect of doing a profitable business. A time limit will be allowed for carrying out such projects. This is not likely to create alarm in any quarter. Hereford will be remembered. And the Commissioners, there is little doubt, will also take good care that they do not impose anything in the nature of compulsory supply to areas that will have the effect of lowering the efficiencies and economies of any undertaking as a whole. The Commissioners stress the importance of non-statutory companies raising their status to the statutory. Among their other functions, the Commissioners have issued 29 Special Orders for the extension of existing areas. These notes only touch two or three sides of the work of the Commissioners. Of course, the Department and the work entail considerable expenditure, which the industry has to bear; but still it cannot work-out, taking the whole industry, to a large sum per undertaking. For the year to March 31, the expenditure was £37,979, made up of salaries £34,017, and general expenses £3962. Added to this there was £3384 in respect of accrued interest on advances by the Treasury; and as a deduction £1470 paid to the Commissioners as fees for Special Orders, &c. This leaves a balance of net expenditure of £39,893.

Electric Power in Gas-Works.

The "Electrician" has issued its annual special "materials handling" number; and it contains two articles which deal with the movement of materials in gas-works, using the electrical drive. The electrical papers are pleased to quote the utilization by gas-works of electric power, as evidence of an open admission by gas engineers that it is superior to the gas drive. They will not acknowledge, or they do not appreciate, that this is really testimony to good, broad-minded engineering, in that it demonstrates that the choice of the power agent depends upon the character of the functions to be performed by the machinery to be driven. One of the articles is by Mr. H. C. Widlake, of the Plymouth and Stonehouse Gas Light Company. He explains the operations on a gas-works to which electric

power can be applied; and then supplies illustration by what has been done at Plymouth, under the engineership of Mr. Percy S. Hoyte. Another article is by Mr. H. Blyth; and gas-works utilization of the electric drive has a somewhat large part in it. It is a more general contribution than that of Mr. Widlake. It is considered by Mr. Blyth that the electric motor is so superior in efficiency, convenience, and facility of control, compared with any other form of drive, that it is now unnecessary for electricity supply undertakings to engage in any kind of propaganda to extol its special advantages. He, however, freely admits that the thermal efficiency of extracting energy from coal through the medium of the steam-boiler, steam-engine, and dynamo, is very much less than that of the carbonization of coal and the use of an internal combustion engine; but he adds that, while it is very much to the interest of the gas engineer to demonstrate the application of gas to the problems of power supply, these facts and interests have been more and more overborne by the enormous saving in the transmission of power, and the great convenience with which the electric motor can be applied under conditions which would be quite impossible for any other drive. But that argument does not by any means confer upon the electric drive a universal application on the score of economy; and this is amply proved by the fact that, in order to secure a competitive economy, the tendency is, where there can be a grouping of machines, to advocate the utilization of an electric motor in combination with shafting and gearing. But we shall have to look after the gas-lighting load. Mr. Blyth points out that there is a large field here for electricity to take over; and many electricity undertakings now need this, in view of the dimensions of their power load. Incidentally we notice that at Bristol the proportion of output is 15 p.ct. for lighting to 85 p.ct. for power purposes. This tells a tale of need. He then refers to gas as being an alternative for power, and makes the point as to the utilization of electric power for assisting in the production of its rival. He disagrees with the practice of gas engineers installing special gas-engine driven dynamos. The load factor afforded by gas-works plant is, he submits, uneconomical; and apart from the question of the low working cost of the plant due to the high thermal efficiency of the engine, he thinks the poor load factor is a real obstacle to the production of current at an over-all cost which can compete with current produced on a considerable scale for a large variety of power users. In this argument, the writer overlooks that reliability is an important consideration for gas-works; and it would never do for the failure of supply at the electricity station to interrupt simultaneously the supply of gas to a community. In fact, the gas industry takes a large pride in its immunity from collapses of supply, and generally it prefers not to import any risk into its operations. But Mr. Blyth in this connection points out that the recovery of waste heat from gas-producing plant, and the generation of steam by it, create new possibilities on gas-works in respect of power.

Collapses.

Gas has been unfortunate lately through the fracturing of distribution mains by subsidence or heavy traffic which the roads were not constructed to carry. But most modern public conveniences have their trials and difficulties through accidents. Electricity is not immune. Year by year several people are electrocuted; and quite recently there were the cases of two children being killed by the falling of overhead wires. A curious thing is that just about Christmas time several failures of electricity supply are usually recorded. Among those reported lately was a collapse at Dover, which interfered with Christmas shopping. The tramways and all electrically driven machinery, including the pier cranes, ceased their activities. The shops had to resort to such primitive means of lighting as candles and oil-lamps. That was on Dec. 21. The same day Whitby was subjected to a similar experience. Users of the electric light at Walton-on-the Naze have also recently been put to similar inconvenience. An explosion in an electric street box at Preston also deprived a district of electricity for several hours. Greenock had an interruption of supply on a recent Friday evening owing to a "blow-out" in one of the turbo-generators. There was damage by fire and water at the generating station. The load was changed to another set in about three-quarters of an hour. The famous cathedral at Quebec has been destroyed by fire. Local correspondents state that it was "possibly caused by faulty electric wires." The critics at a distance will no doubt ridicule this.

Public Lighting.

Periodically there comes a burst of desire on the part of local authorities owning electricity undertakings to increase the lighting load by extending cables at a heavy expense for the purpose of converting street-lamps from gas to electricity. There is no justification for this, whether viewed from the standpoint of economy or of efficiency. Where the gas and electricity supplies are both under private enterprise, there is not the same inclination to make conversions from gas to electricity. This shows very conclusively that possession of the electricity supply by the local authorities is the dominating influence. What gain is there in making such conversions? A heavy capital expenditure is incurred. The ratepayers have to pay, directly or indirectly. The current for public lighting has to be charged for at a lower price than in the case of private lighting; and in many places where the lighting load forms the peak in the curve of a day's output, the street lighting requirements raise that peak still further, yet the revenue per unit is low in comparison with private lighting. If the lighting efficiency were improved in comparison with gas lighting, there might be something to be said for the change. But as a matter of fact, it is not. If the gas-lighting fittings are antiquated, the transfer to electric lighting might be an improvement; but the change to modern gas lighting, with its high lighting efficiency for street purposes, could be effected at a small cost compared with a change-over to electric lighting. Consideration of the ratepayers in this matter has second place where the electricity supply is controlled by the local authority; and this is not good government. At Newmarket, where both gas and electricity are private enterprises, a street lighting contract has been entered into with the Gas Company for ten years; and the lamps are going to be modernized. The Electric Light Company had a chance of tendering; but as a capital outlay of approximately £7000 was involved, the Directors did not feel disposed to tender, unless the Council could see their way to repay the amount with interest at 10 p.ct. extended over a period of ten years. They could not. How different that picture from what is found where there is municipal ownership of the electricity concern!

Samples of Extravagance.

Illustrations of this extravagance are not difficult to find. Two are immediately at hand. At Willesden, the Lighting Committee and the Electricity Committee appear to have put their heads together in giving consideration to a report by the Electrical Engineer on the subject of lighting the streets, with the result that the inter-related parties have resolved upon the conversion from gas to electricity at the termination of the contract with the Gas Light and Coke Company. The estimated capital cost of this is £32,219. The Council have given their approval; and an application is to be made to the Electricity Commissioners and the Ministry of Health for their sanction to the necessary loan. So the ratepayers are to be saddled with that additional burden, for which there will not be any compensating advantages. The other example comes from Beckenham. There the District Council have adopted a recommendation of the Works Committee to substitute electricity for gas for public lighting. It appears that there are 621 lamps adjacent to the electric mains which could be supplied without cable extensions, and a further 233 lamps which would require the laying of new cables. These additional cables, if of sufficient size, would, it is said, enable a supply to be given not only to the street lamps, but to all ratepayers who desire current. The extra cables sufficient for the public lamps only would cost approximately £6349; but it is proposed to expend a further sum of £2651 in order to provide mains to deal with a reasonable amount of private lighting. On top of this there is the cost of conversion of the lamps; and the total estimate of capital expenditure works-out at £19,978. The Electricity Committee state that they are prepared to supply 120 c.p. lamps, corresponding to the lighting power of the present gas-lamps, for £4 15s.—a total annual charge of £4057, as against the Gas Company's proposal of £5 per lamp per annum, or a total of £4270. The Electricity Commissioners are asked to sanction a loan of £20,000; and the annual revenue of £4057, it is declared, will be "more than sufficient" to cover all costs, including capital charges, and provide a reasonable profit. We should like to see the details of the calculations upon which this estimate is based. Ten per cent. for interest and sinking-fund charges would alone require £2000 a year. If we assume all-night lighting, and so 4327 hours a year, and that the lamps (if gasfilled) will use 0·75 watt per candle power, or 90 watts per hour, this would equal 389 units per lamp per annum. These at 2d. per unit would cost £3 4s. 10d., leaving £1 10s. 2d. for maintenance, renewals, labour, capital charges, &c. These are hypothetical figures; but there is sufficient in them to question the all-covering power of the revenue of £4057. There seems to have been some fine cutting.

Charges for Connections.

A Legal Correspondent in the "Electrical Review"—Mr. W. S. Kennedy—discusses the question as to charging for the portion of the service cable on a consumer's premises, as well as for connecting-up the supply. Electricity undertakings have an indisputable right to do this; but Mr. Kennedy appears to be doubtful as to whether such charges pay in the long run. He apparently believes in reducing incidental costs to the consumer as much as possible, seeing that it is the widest possible use of electricity that pays best, and that this can only be promoted by making it as cheap as may be. Of course, there are arguments both ways. These things cost money; and if there is no direct charge, the expense has to fall on to the consumers through their supply, and the heaviest consumers pay most. The fairest course is to charge for work where permissible, and to keep the cost of the current free from extraneous expenses. Mr. Kennedy, however, asks whether it is not worth considering whether an authority which makes no charge for connecting will not, in a short time, so increase the number of its consumers as to be more than repaid for any possible initial loss. We would ask Mr. Kennedy to look at the matter also from our point of view.

Institution of Heating and Ventilating Engineers.—Dr. B. R. Wingfield is to deliver a lecture next Friday evening on "Automatic Temperature Control," before the Institution of Heating and Ventilating Engineers, at the Engineers' Club, Coventry Street, London, W.

DETERMINATION OF VOLATILE MATTER IN FUELS.

A note on this subject which was submitted at a meeting of the Yorkshire Section of the Society of Chemical Industry on Nov. 20—Prof. J. W. Cobb in the chair—by Messrs. P. Wedgwood, B.Sc., and H. J. Hodsman, M.B.E., M.Sc., F.I.C., of the Department of Coal Gas and Fuel Industries, Leeds University, is reproduced in the December issue of the "Journal" of the Society.

The determination of the volatile matter, the authors said, is one of the most important tests applied to fuels for both commercial and scientific purposes. For commercial testing a high degree of precision in the determination is unnecessary; but owing to the empirical character of the tests, a uniformity of method is desirable which will not be secured unless the apparatus is simple and inexpensive. The method originally proposed by the American Chemical Society, in its modified form, has been widely adopted as forming the nearest approach to this want. Unfortunately, in this method the use of a crucible of platinum is specified. Platinum has obvious advantages; but as its cost is practically prohibitive, there is no hope that it will come into general use for the commercial testing of coal. Materials such as porcelain and silica differ so much in properties from platinum as to make their substitution in the American test impossible. A satisfactory substitute should be metallic, as otherwise the temperature necessary is unattainable in a crucible heated in the bunsen flame.

After examining a number of metals and alloys, they have found two materials—though, of course, there may be others untried by them—which proved reasonably satisfactory. They were Monel metal and mild steel treated with aluminium powder. For this purpose the crucible embedded in aluminium powder enclosed in an iron tube was heated in the muffle. The crucibles (turned out of the solid) were similar in dimensions to the ordinary platinum crucible.

To test the constancy of weight, the crucibles were heated for periods of seven minutes in the flame of a Méker burner, to a temperature of 950° C. The gain in weight indicated that the effect of oxidation of the crucible in a determination of volatile matter in 1 gramme of fuel would be to lower the result by 0·5 p.ct. or less as compared with determinations in platinum. In use the gain in weight should be still less, owing to the reducing atmosphere inside the crucible. The crucibles also seemed to develop in use a protective film of oxide.

A large number of coals have been tested, using these two base-metal crucibles and a platinum crucible. The temperatures in the crucibles at the end of each minute during a period of seven minutes' heating under the conditions of a test were measured. The temperature inside the platinum crucible rose rapidly to the maximum in two minutes; but in the base-metal crucibles only after four minutes. Thus the charge was at 930° C. in the platinum crucible for five minutes, and for three minutes only in the others. When the crucible and its contents were subjected to a preliminary gentle heating for two minutes before heating for seven minutes at the full temperature, the results in each case were lower and more concordant.

The results obtained in the base-metal crucibles are generally about 0·5 p.ct. low when compared with those determined in platinum. This difference may be ascribed to various causes, of which the most obvious are: (1) The increase in weight of the crucible depressing the apparent loss of volatile matter. (2) The greater loss by entrainment of carbon particles in the stream of volatile matter, due to the more rapid rise in temperature in the platinum crucible. (3) The fact that, whereas the platinum crucible is at a temperature above 900° C. for about six minutes of the seven minutes' period, the base-metal crucibles are only maintained above this temperature for about four minutes.

But whatever crucible is used for volatile matter determinations, in order to obtain concordant results a specified procedure must be strictly adhered to. In commercial work extreme precision is unnecessary, and a knowledge of the volatile matter to the nearest 0·5 p.ct. in most cases is sufficient. In view of this, and the fact that consistently good results can be obtained with suitable base-metal crucibles, the use of platinum does not seem essential.

Of the two materials tried, Monel metal seems to behave the better. The crucibles can be turned in the lathe to a standard size and thickness. The finished crucible maintains in use its smooth surface and original shape. In this respect it is superior to platinum, which is soft and easily deformed. Above all, the metal withstands the continued action of heat exceedingly well. Experiments showed that the crucibles may not be used for determinations of volatile matter made in the muffle, the protective atmosphere of the flame being essential.

Forthcoming "Fuel Symposium."—Meetings of the Society of Chemical Industry on the evenings of Tuesday, Jan. 23, and Tuesday, Feb. 6, at the University, Edmund Street, Birmingham, have been set apart for a "Fuel Symposium," when the following gentlemen will discuss fuel problems: Mr. E. V. Evans, F.I.C., O.B.E., Mr. E. C. Evans, B.Sc., F.I.C., Mr. R. E. Keeling, Dr. C. H. Lander, Dr. A. Parker, and Dr. E. W. Smith.

THE HOYLAKE AND WEST KIRBY BILL.

Reorganizing the Capital—The Therm Proposals.

THE Hoylake and West Kirby Gas and Water Company have a Bill in Parliament for incorporating and conferring further powers upon them.

In the preamble, there is a statement as to the share and loan capital which the Limited Company had issued and borrowed up to June 30 of last year. This shows that in respect of gas capital they have been authorized to borrow £58,500, and for their water undertaking £75,000 (excluding any premiums received on the issue of 2000 £5 shares under their Order of 1887), with power to borrow on mortgage to the amount of one-half of their gas capital, and one-third of their water capital, for the time being issued and paid-up. The total amount of gas share capital paid up is £42,685, on which premiums have been paid amounting to £6572, which leave still unissued £9243. In respect of the loans on gas capital, the total sum borrowed is £20,050 out of a total authorization of £29,250. A difficulty has arisen in connection with the capitals of the two undertakings, in that some of the shares of the Company participate in the profits of both the gas and the water undertakings, and the mortgages participate only in the profits of, or are secured only upon, either the gas or the water undertaking. This has created confusion as to rights and interests attaching to the several classes of shares and mortgages to such an extent that the Committee of the Liverpool Stock Exchange in 1913 withdrew the quotation of those shares from their official list. This action has been prejudicial to the issue of, and dealings in, the shares and mortgages; and further inconvenience is caused by the provisions of the Company's Orders, which enact that capital moneys required for the development of the gas undertaking and the water undertaking respectively shall be raised by separate shares or stock and separate mortgages with different rights and privileges in respect of each undertaking. Hence it is regarded as expedient that the Limited Company should now be dissolved and re-incorporated as a Gas and Water Company with a common capital. A further matter dealt with in the preamble is a new districting agreement with the Birkenhead Corporation; and power is asked that the Company be authorized to supply gas and water within the limits defined, and that the powers of the Birkenhead Corporation to supply gas or water within those limits be repealed.

Turning to the clauses, those providing for the incorporation are of the usual order. Succeeding are the clauses dealing with the capital. It is proposed that the capital shall be £140,000, of which £108,888 shall be called original capital, and shall be substituted for the existing share capital of the Limited Company, and £31,112 is to be known as the additional capital. It is intended to create £92,838 ordinary stock, and £16,050 redeemable preference stock entitled to a preferential dividend of 7½ p.ct. per annum, and redeemable at par on Dec. 31, 1941, or at the option of the Company at any time previous to that day, but after Dec. 31, 1931, on six months' notice being given to the persons who at the date of such notices are entered in the register as the holders. The £92,838 ordinary stock, and the £16,050 redeemable preference stock are to constitute the original capital until the preference stock has been redeemed; and after the redemption, the original capital will then consist of £92,838 ordinary stock, and such further stock may be created and issued under the provisions of a later section dealing with redeemable preference stock. The scheme provides that the ordinary stock shall be divided among the registered holders in the proportion of £7 2s. 10d. for each "A" gas and water share held by them respectively, and £5 of such stock for each "B" gas share or each "B" water share. The £16,050 redeemable preference stock is to be divided among and vested in the several persons who immediately before the appointed day were registered as holders of the redeemable preference shares in the proportion of £5 of such stock for each share. In a subsequent clause, the issue of additional capital is dealt with; and under this the Company propose to take power to issue an amount sufficient to produce, including premiums, £31,112. In this connection, a clause appears proposing that, during the period of three years from the passing of the Act, or such extended period as the Board of Trade may allow, the Company may, subject to conditions imposed by the Board of Trade, offer any stock for subscription by the public, and upon any such offer may pay a commission not exceeding 5 p.ct. to any person in consideration of his subscribing, or agreeing to subscribe, whether absolutely or conditionally, for any such stock, or procuring or agreeing to procure subscriptions. Except, however, as so provided, all stock is to be issued in accordance with the provisions applying to sales by auction or tender.

As to borrowing powers, the Company ask to be allowed to borrow on mortgage in respect of the £92,838 ordinary stock any sum or sums not exceeding in the whole (inclusive of the £38,150 borrowed to June 30 last), the sum of £49,861 10s., being one-half of the amount of the cash received on the issue of the ordinary shares of the Limited Company. Further, the Company desire to be empowered to borrow on mortgage in respect of the £16,050 redeemable preference stock, and any stock which shall be substituted therefor, any sum or sums not exceeding in the whole £8043 15s. Further, sanction is sought to borrow any sum not exceeding in the whole one-half of the additional capital which, at the time of borrowing, has been raised under the powers of the present measure. Authorization is sought to the issue of redeem-

able preference or debenture stock. Separate accounts in respect of capital expenditure and revenue are to be kept of the gas and water undertakings. The expenses of direction and management and other common expenses are to be apportioned between the separate accounts in such manner as the Directors deem just. An account is to be kept to which shall be transferred from the separate revenue accounts sums not exceeding prescribed amounts, out of which shall be paid all interest and dividends on the mortgages, debentures, and stocks. The sums to be so transferred are those necessary to pay the interest or dividends for the year on borrowed money, or in respect of redeemable preference stock, as well as a sum calculated at the rate of 7 p.ct. per annum on the original and ordinary capital of the gas undertaking and the water undertaking respectively. Further as to dividends, the profits to be divided among holders of the preference capital in any year are not to exceed 7½ p.ct. on the £16,050 redeemable preference stock, or 7 p.ct. on such preference stocks as may be created under the provisions of sections bearing the marginal notes "Redemption of £16,050 Redeemable Preference Stock" or "Power to Raise Additional Capital." Further, the profits to be divided among the holders of the ordinary capital is to be such a sum as may be determined in general meeting. The Company are to be under no obligation to hold ordinary general meetings more than once a year. They ask for power to provide for the redemption of the capital moneys expended on or in the acquisition of leasehold premises for the purposes of their undertakings. A special purposes fund is also provided for. Works clauses follow, to which the secondary products one-third limitation is attached.

As to the price to be charged for gas, 18·5d. per therm is suggested; and to this the sliding scale is to be applied. For prepayment supply, the hire charge is to be 3d. per therm if a cooking-stove is included, and 2·5d. per therm if a cooking-stove is not included. The charge for the hire of a prepayment meter without fittings is to be a maximum of 1·5d. per therm, or at the rate of 10 p.ct. per annum on the cost of the meter, whichever shall be the higher. Differential prices are proposed for gas supplied for various purposes. The Company intend to declare a calorific value of 450 B.Th.U., and attached thereto are the necessary clauses referring to variation of calorific value, adjustment of consumers' burners, and pressure of gas. A number of miscellaneous clauses appear, including a stand-by provision empowering the Company to charge a minimum sum not exceeding 25s. per quarter, and also one giving sanction to the supply and the purchase of gas in bulk.

Passing over the water section of the Bill, there are clauses that are common to both gas and water. One of these refers to supplies to caravans, shacks, and huts. Later on, there is the provision as to the repeal of the powers of the Birkenhead Corporation within portions of the Parish of Bidston-cum-Forde. [*Parliamentary Agents: Messrs. Torr, Durnford, and Co.*]

Dry Quenching of Coke.

Mention has already been made in the "JOURNAL" of the fact that Messrs. Sulzer Bros. have demonstrated at the Zurich Gas-Works the practicability of utilizing the heat given off by drawn coke during cooling. By this system, no water is used for quenching, and the heat of the coke is employed for generating steam. The apparatus consists of a tall brick-lined chamber built alongside a vertical tubular boiler, with a fan to circulate the heat from the coke. The current is upwards through the mass of coke, and downwards through the boiler. The hot coke is dumped, as made, through swing gates on the top of the coke chamber, and withdrawn in batches from the bottom when cooled to about 250° C. Very little air can enter the circulation even when dumping or withdrawing coke, because the chamber is situated on the delivery side of the fan, and is under a slight pressure. It is stated in the "Bulletin" of the Semet-Solvay and Piette Coke-Oven Company, Ltd., that the Piette ovens at Homecourt Steel-Works are now being equipped on the same principle, being the first installation on the large or coke-oven scale. The hot coke will be received on coke cars, which are raised on hoists located at the ends of the batteries of ovens. The coke slides off the cars into the chamber through balanced covers, and is drawn, when cool, on to band conveyors leading to the screens. The ovens will produce about 1000 tons of coke per 24 hours, and the heat of the coke will generate 28,000 lbs. of saturated steam per hour at a pressure of 140 lbs. per sq. in. Steam turbo-generators are being installed; and of the total power generated, about 10 p.ct. will be required to run the apparatus itself. A large economy in coke consumption in the blast-furnace is anticipated from the elimination of moisture in the coke.

Institution of Mechanical Engineers.—A symposium of papers on "Indicators" will be discussed at a meeting of the Institution, at Storey's Gate, St. James's Park, on Friday evening, Jan. 19. Prof. F. W. Burstall is the author of one of the papers included in the symposium.

London and Southern District Junior Gas Association.—This (Wednesday) afternoon, members are visiting the Haggerston stove and meter works of the Gas Light and Coke Company. At a meeting in the Westminster Technical Institute on Friday evening, Jan. 26, Mr. P. E. Browne, Distributing Engineer to the Brighton and Hove General Gas Company, will deliver an address entitled "From the Gasholder to the Householder."

FUEL ECONOMY ON GAS-WORKS BOILERS.

By T. W. ANDREWS, of the South Metropolitan Gas Company.

[A Paper read on Dec. 15 before the London and Southern District Junior Gas Association.]

Fuel economy is a very wide subject; but with the limited time at my disposal it is only possible to touch the fringe of the matter. I wish it to be clearly understood that I do not claim any super-knowledge of the subject; but it has been my good fortune to be closely in touch with numerous plants, both inside and outside the gas industry, which enables me to take a broader view of this matter than some of my less fortunate fellows. A great deal has been written concerning economy with coal-fired boilers, much of which is unsupported by anything in the nature of facts and original information. While it is the general opinion that boiler plants, as a whole, are inefficient, very little information comes to light as to how inefficient they really are. This fact is very important, because until reliable information is forthcoming in the shape of factors contributing to the losses that undoubtedly take place, very little action can be expected on the part of the steam user to remedy the defects.

CLASS OF FUEL.

In the process of coal carbonization, there are always to be obtained large quantities of coke breeze on the works, generally also within a stone-throw of the boiler bunkers. It is the economy of this class of fuel that concerns us in this industry. Because coke breeze may be cheap and plentiful on the works where it is produced, is no reason why those responsible should neglect to obtain the full measure of its value as a steam-raising fuel. It is gratifying to note that its importance as a fuel is being rapidly recognized in industries outside our own, so that the problem of "What shall we do with the surplus breeze?" that probably worried the past generation of gas engineers, does not exist to-day. Certainly during the latter stages of the great European war the calorific value, in common with other solid fuels, depreciated considerably, which was again repeated with the importation of foreign coal for the purpose of carbonization during the recent labour trouble on the British coalfields. It is equally certain that coke breeze produced from English coal is equal, and in some cases superior in value, when compared to certain bituminous slacks. It is quite possible, under normal working conditions, to obtain an equivalent evaporation of 6 lbs. per pound of fuel, from and at 212° Fahr., with coke breeze of 9500 B.Th.U.

There does not seem to exist any strict definition of coke breeze. Some would describe it as all the material passing through a ⅝ in. screen. For the purpose of the matter under review, however, the average results of several screening tests are given in the subjoined table, together with the average analysis for each grade.

Grade of Fuel.	Moisture.	Volatile Matter.		Fixed Carbon.		Ash.		Calorific Value.		Weight of Fuel Remaining on as Percentage.
		Wet Basis.	Dry Basis	Wet Basis.	Dry Basis	Wet Basis.	Dry Basis.	Wet Basis B.Th U.	Dry Basis B.Th.U.	
	P.Ct.	P.Ct.	P.Ct.	P.Ct.	P.Ct.	P.Ct.	P.Ct.			
Nuts ½ in.	9·38	2·89	3·18	65·95	72·83	20·97	23·21	10,300	11,370	34·12
Beans ⅜ in.	9·48	2·77	3·10	65·65	72·51	22·09	24·44	10,100	11,150	9·58
Peas ¼ in.	8·89	2·79	3 07	67·44	73 98	20·88	22·96	10,490	11,500	2·95
Fines ⅛ in.	9·72	3·37	2·99	63·85	70·71	23·05	25·55	10,100	11,180	33·15
Dust . .	9·93	4·02	4·46	64·51	71·57	21·57	24·01	10,320	11,470	20·20

Classification of Screened Coke Breeze.

Nuts = Fuel remaining on ½ in. sieve.
Beans = ,, passing through ½ in. sieve but remaining on ⅜ in. sieve.
Peas = ,, ,, ,, ⅜ in. ,, ,, ,, ,, ¼ in. ,,
Fines = ,, ,, ,, ¼ in. ,, ,, ,, ,, ⅛ in. ,,
Dust = ,, ,, ,, ⅛ in. ,,

It was originally thought that, by screening out the finest portion of the breeze or dust, a better fuel would result by reducing the ash content. The results of many screenings, however, did not confirm this. One sample of breeze screened and analyzed from the nuts downwards, may show a steady decrease of the ash contents, with a corresponding increase in thermal value, while another sample may prove entirely opposite. Other samples, again, show the ash content to be fairly consistent throughout. It was proved, both by analysis of the fuel and thermal efficiency obtained from the boilers when using the screened portions, that there is no advantage obtained likely to justify the cost of screening.

BOILERS.

Lancashire Boiler.—The class of boiler most common to gas-works is the Lancashire. Its selection even for modern works is no doubt due to its excellent steaming qualities, and its suitability for inferior class fuels. It is a cylindrical internally fired boiler, having two flues or furnace tubes extending the full length of the shell. The furnace gases, after passing over the bridge, proceed along the remainder of the furnace tube into the combustion chamber at the rear end, and from thence along a brick chamber common to both furnaces beneath the boiler shell to the front of

same, where the gases divide and return along side flues, and thence to the main flue or shaft in the absence of economizers.

Galloway Boiler.—Another fairly common type of boiler is the Galloway. The furnace tubes of this boiler are quite short, and lead into a larger and oval-shaped chamber which forms part of the structure of the boiler. This chamber contains a forest of vertical water tubes, which gives this class of boiler a larger heating surface when compared to a Lancashire of like over-all dimensions. The path of the gases is the reverse of the Lancashire; the side flues form the second pass, and the bottom flue the last. With the use of coke breeze, full advantage of the increased heating surface due to the cross water tubes is not obtainable, owing to the rear chamber of this boiler offering shelter to the drift or fine ash deposit (referred to later). Where modern methods of scaling are not available, the steaming capacity of this boiler may be further reduced owing to the difficulty of hand scaling the cross tubes.

Water-Tube Boiler.—It is not uncommon to find small type water-tube boilers working in conjunction with Lancashires. Where the load on such a plant is of a fluctuating character, the water-tube section will readily meet the peak demands for steam, while the Lancashire section will provide the reserve. This type of boiler is very sensitive to slight changes of pressure or conditions of the furnace, which is of great importance where breeze is concerned. It is the writer's opinion that, so far as the water tube is concerned, low-grade fuels should be eliminated. Higher efficiency and an increased duty of approximately 75 p.ct. would result from the use of graded coke with this class of boiler under working conditions.

Human Element—The Chief Factor.

It is the writer's opinion that very little can be accomplished in the matter of fuel economy, especially with hand-fired plants, without inviting the support and intelligent co-operation of the boiler stoker. It is an unfortunate fact that very little interest in the past has been taken in this man or his work. Good stokers are valuable men—more valuable than can be understood without inside knowledge and experience of their daily work. It is not always the man handling the most fuel who produces the most steam. As an illustration—it is not an uncommon experience where two firemen are working side by side to find the one doing more manual work than the other; closer observation will prove the other is not slacking. Far from it, he is putting more skilled effort into his work, and by so doing is balancing the poor results of his apparently harder working, but less efficient, mate. The day is long past when brawn should be the deciding factor in choosing men for the firing of boilers; the brain factor should at least receive some consideration. It is not sufficient to watch steam gauge and water level; the time is more than ripe when the man should understand at least the elementary principles underlying his work in the boiler-house.

The training of boiler firemen, with which the writer has had some experience, is a matter of fundamental importance where efficiency of the plant is concerned. It was the duty of the writer recently to undertake the training of stokers in so far as the use of coke breeze was concerned. It will no doubt be appreciated that the preparation of the course required some hard thinking. It was not a matter of dealing with raw material; fully 90 p.ct. of the men had completed five years and more with the shovel, either afloat or ashore.

The plant chosen for the purpose of a training centre consisted of two Lancashire boilers, 28 ft. by 8 ft. The load conditions closely compared with that of the plants from which the men trained were drawn. The boilers were in continuous operation. It was therefore possible to have three men in training at one time (eight-hour shift per man). Each stoker spent from twelve to twenty shifts at the school, the period depending on the progress made.

The equipment comprised a platform weighing machine capable of weighing from 1 lb. to 10 cwt., two feed-water tanks holding a known volume by weight, two CO_2 recorders (one attached to each unit), steam pressure recorder, five pyrometers (one inserted at the exit of each wing flue, and the other in the shaft), and last, but not least, a few fuel sample bins. From the data provided by this equipment it was possible to treat each shift as a complete steam trial, conducted in each case under purely normal working conditions. The "centre" was in existence for a considerable period, during which no less than 631 tests of eight hours' duration were carried out, nearly 2000 tons of breeze were consumed, and over 2½ million gallons of water were converted into steam. From the mass of figures produced, it is possible to prove that the training of stokers is necessary as the first step to fuel economy.

The tabulated results only convey the average progress made in the matter of better stoking methods. The average efficiency result from the first test with each man gives a figure of 53 p.ct., likewise the average for the last shift test with each man gives a figure of 65 p.ct., or an all-round improvement of 12 p.ct.

It is necessary to point out that at no time was this plant allowed to be put in a maximum state of cleanliness. Scale was never less than an average of 1/16th of an inch, while the flues always contained a large amount of drift or dust. The chief object at all times, apart from that of training the men, was that the plant should be as near as possible, so far as conditions were concerned, representative of the plants from which the men were drawn.

Average Result of 631 Steam Trials.

Particulars of Boiler—	
Number of boilers	1—3
Type	Lancashire.
Size	28 ft. by 8 ft.
Heating surface	1180 sq. ft.
Grate area	44·2 sq. ft.
Nature of draught	Forced.
Conditions of Evaporation—	
Temperature of feed	62° Fahr.
Steam pressure (absolute)	91·5 lbs.
Heat supplied to each lb. of water	1149·8 B.Th.U.
Factor for equivalent evaporation	1·19
Quantity of Fuel Burnt—	
Total weight in lbs.	6750 lbs.
Weight per hour in lbs.	844 lbs.
,, burnt per sq. ft. grate per hour	19·1 lbs.
Calorific value per lb. as fired	9650 B.Th.U.
Quantity of Water Evaporated (Actual)—	
Total quantity evaporated in lbs.	34,814 lbs.
Quantity evaporated per hour in lbs.	4,352 lbs.
,, ,, ,, sq. ft. heating surface per hour in lbs.	3·69 lbs.
,, ,, ,, lb. fuel as fired in lbs.	5·15 lbs.
Equivalent Quantity of Water Evaporated—	
Total equivalent evaporation from and at 212° Fahr. in lbs.	41,428 lbs.
,, ,, ,, per hour in lbs.	5,178 lbs.
,, ,, ,, per sq. ft. heating surface per hour in lbs.	4·39 lbs.
,, ,, ,, per lb. of fuel as fired in lbs.	6·12 lbs.
Thermal efficiency	61·3 p.ct.

CO_2 Recorders.

Analysis of the flue gas is very important where fuel economy is considered. Short snap samples are of little or no value as a guide to the stoker for controlling furnace conditions. Experience shows that such conditions are ever-changing with coke breeze. It therefore becomes necessary to provide some means whereby the gases can be constantly analyzed and a permanent record produced on a tape or chart. There are numerous combustion recorders on the market to-day capable of automatically collecting and analyzing from fifteen to twenty samples per hour. When fitting these machines, care should be taken to provide means for periodical clearing of the gas-pipe line from recorder to flue. There is with all classes of fuel a tendency for foreign matter to build-up on the internal walls of this pipe-line at a fairly fast rate. It is therefore necessary to pass a rod through the entire line once or twice weekly. Failure to do this will lead to a complete blockage of the pipes. It is the writer's experience that more bad language has been directed to this very useful apparatus than to anything else on the plant; but to obtain best results it is only necessary to apply a system of attention based on common sense.

Furnaces.

It has been said that coke breeze can be burnt successfully with the aid of natural draught alone. This may be correct, but what must the chimney loss be to provide the draught necessary? The fuel bed composed of breeze, at its best, is a closely packed and practically non-porous mass. The duty from the boilers under such conditions would be considerably reduced, in company with the efficiency. Again, coke breeze depends for success as a fuel upon radiation. In actual practice, so far as the Lancashire type is concerned, the major portion of the evaporation is carried out in the front half of the furnace tube. Consequently it is of the utmost importance to promote furnace efficiency. This can only be obtained by the use of forced or induced draught. Probably because of its convenience the system most favoured on gas-works is the former. There are many makes of forced draught furnaces on the market, each claiming some special feature of importance; but experience with the problem of efficient combustion with coke breeze proves that ultra-caution is necessary in selecting this all-important apparatus.

There are so many factors to be taken into consideration where breeze is concerned, that one's best guide in the matter should be a comparison of results from tests carried out under strictly normal working conditions. All the furnace makers of repute will be found ready to arrange such tests on one's own works. Experience in this direction has proved that the essentials of an efficient furnace are:

(1) The grate surface should be 3 in. at least below the centre line of the furnace flue.
(2) The grate should be so designed that its area can be adjusted without having to order special length bars, as is the case where bars are placed at right angles to the furnace door.
(3) The air spacing should be so arranged as to prevent the loss of the fines previously mentioned.
(4) That no provision be made for air supply other than through the fuel bed.
(5) That the air supplied be so directed as to promote an equal rate of combustion both ends of the grate.
(6) That the bars be of deep design to promote the rapid transfer of absorbed heat to the inflowing air.

(7) That the air supplied under pressure be so introduced that "blowing" the fuel bed at various points is eliminated. This is found to be a bad fault with furnaces where the air under pressure is introduced into the ash pit.

LOSSES AND REMEDIES.

It is not to be understood that low efficiency lies solely at the door of the average boiler stoker. Far from it, the stoker is sometimes blamed unwittingly for something over which he has no control. The writer's own experience in this matter was that generally speaking the man firing the boiler required little persuasion to arouse his interest in the matter of obtaining better results; it being always necessary, however, to ensure his efforts were not in vain.

It is obvious the first step necessary to higher efficiency is measurement—to find out what a particular plant is doing. The weighing of the fuel and the method of metering the water should be above suspicion. Generally speaking, the weighing of fuel *en route* to the bunkers is a quite simple and good enough method; but with the measurement of water, it is different. Where the meter used (if one is used) is of the enclosed type, it should be fitted with a bye pass and test tank for the purpose of periodical checking. An excellent type of the open class is the V notch meter, in which the water flows through a V notch of given dimension, and, by means of a float mechanism, a continuous record is kept of the height of the water in the notch; the amount of water passing being proportional to the height in the notch. It is possible, with this class of meter, to show, by means of the chart provided, all fluctuations of the load operating over 24 hours.

LOSSES DUE TO IMPROPER DRAUGHT CONTROL.

The dampers should be so placed that they are within easy reach of the stoker, to be operated in conjunction with the combustion recorder. It is not to be expected that the stoker will make full use of this instrument if the damper control is outside or at the back end of the boilers.

The loss of heat in the excess air when working with various percentages of CO_2 is shown in the following table (calculated for a waste gas temperature of 430° Fahr.).

13 p.ct. CO_2	4·3 p.ct.
11 ,, ,, ...	6·3 ,,
9 ,, ,, ...	9·1 ,,
7 ,, ,, ...	13·4 ,,

The above figures do not include loss in products of combustion. Where the waste gas temperature is higher than that quoted, the loss in the excess air would also be higher.

RELATION OF HEATING SURFACE TO GRATE AREA.

It is sometimes found that the grate area is in excess of that necessary for maximum efficiency. The excess area leads to increased fuel consumption, which is reflected in the temperature of the waste gases. Tests carried out have shown that this additional consumption does not materially affect the output of steam, which is probably due to insufficient heating surface for the grate area provided. Experience has indicated that best results are obtained with a ratio of heating surface to grate area of 26—1, where breeze fuel is concerned.

CLINKERING OF FURNACES.

It is not uncommon to find a stoker cleaning both fires of the one boiler within a very short space of time. If this system be allowed, the steaming capacity of the unit so treated will be considerably reduced for a time, during which other units of the battery may have to be forced to make-up the loss. Obviously this does not lead to economy. No hard-and-fast rules, however, can be laid down for guidance in this matter; but some attempt should be made to operate the clinkering so as to provide a nearly constant standard of furnace intensity throughout the battery.

DRIFT NUISANCE.

Perhaps the most difficult problem attending the use of coke breeze is the rapid accumulation of fine dust or drift in the flues. With plants burning breeze up to 25 lbs. per sq. ft. of grate per hour, it is necessary to "drop" each unit for flueing after each eight weeks of actual steaming. The problem, so far as the older plant is concerned, is difficult of solution, but suggests the more frequent cleaning of the main flues adjoining the shaft than is usually the case. With the laying-down of new plants, there should be plenty of past experience available to guide those responsible for the lay-out. It is the writer's opinion that the solution is to be found in elevating the boilers and settings, and constructing the latter in such a manner that all nascent dust would be deposited by gravitation into bottom collecting chambers, to be drawn-off at will, and with a minimum of expense.

LOSS OF HEAT DUE TO BY-PASSING.

With both the Lancashire and Galloway boiler it is not uncommon to find heat being lost owing to defects arising through displacement of the brickwork dividing the first and last pass of the gases. If insufficient provision has been made to allow for endwise expansion of the boiler shell, the bricks will be pushed out of place, allowing high-temperature gases to pass direct to the exit flue. This would very much affect the capacity of the boiler. It is always an advantage with this class of generator to provide an iron sleeve over each wing flue adjacent to the damper, for the insertion of a pyrometer, when the defect mentioned above is suspected. When not in use, this sleeve would be sealed by an iron plug or cap. Where brickwork is liable to the crushing effect due to the "breathing" of the boiler, it is an advantage to use a packing such as asbestos rope. Some provision, of course, would have to be made for this addition.

In a paper of this description, it is not possible to deal with several other factors—such as water softening, settlement and filtration, aid to circulation, efficient use of blast, utilization of waste heat, &c.—all of which contribute to the important matter of fuel economy.

DISCUSSION.

The PRESIDENT (Mr. D. Cleave Cross) said Mr. Andrews might be regarded as one of the biggest experts in the gas industry on the subject with which the paper dealt. He had for a long period devoted himself to it, and had probably carried out more tests on boilers and their efficiency than had any other man in the industry. Really they ought to have given him a whole evening, for the paper was absolutely full of points for discussion. However, Mr. Andrews would come along on a future occasion, and give them another opportunity of debating the matter. One very important point was the question of dust. How often one was told, in going round the works, that the boiler man had got very poor fuel. It would be seen from the table that the calorific value of the dust was just as good as for the ½ in. nuts. This was very important, and to him was rather surprising. It only emphasized the fact that there was not much in the poor-fuel complaint. It was really the human element. One could, the author said, get an additional 12 p.ct. efficiency by looking after the boiler men; and it was up to them to do this. He would like to hear something more about CO_2 recorders, as one met very varying opinions with regard to them. Had the author any experience with the sloping baffle bridge?

Mr. F. A. FROST (South Metropolitan Gas Company) said Mr. Andrews had put before them some very valuable data in connection with the economical use of fuel for steam-raising purposes on gas-works. The experience the author had had well qualified him to speak on the matter, and any results given by him must be treated with respect. He was rather afraid that in the past there had been too much tendency among gas engineers to regard their boiler-house installations as plant for getting rid of large quantities of unsaleable breeze, rather than in the light of their ultimate object of generating steam for carrying on the work. So long as the steam was forthcoming, nobody seemed to worry a great deal about how much fuel was used. Methods of coke handling had, however, been much improved of recent years, with the result that there was now not nearly so much unsaleable breeze as formerly; and in many works it was found necessary, in order to maintain the quantity of steam required, to resort to the use of broken and large coke. When one used coke instead of breeze, the question as to whether the fuel was being employed efficiently must arise; and the same thing applied even to breeze consumption, because within the last year or two the value of breeze (which at one time was regarded as practically rubbish) had increased very largely. The author said there did not seem to exist any strict definition of "coke breeze." With this he agreed. If he were to attempt to define some of the so-called breeze he had seen, he would suggest a mixture of earth and water with a sprinkling of carbon particles! There should be a well-paved solid floor, with adequate drainage, so that in no circumstances could the coke breeze lie in water. He thought it would pay large gas companies at any rate to put down a proper screening plant for their coke breeze, and eliminate dust. The dust need not be lost. It possessed a marketable value, and could be used for a variety of purposes. The resultant material would have an enhanced value which would justify the outlay.

Mr. E. W. L. NICOL (London Coke Committee) said that to an outsider the significant feature about steam-raising practice in gas-works was the fact that raw coal in any circumstances was not permitted. This was a fact that ought to be brought to the notice of the London County Council and other public bodies who were investigating the smoke and fog trouble at the present time. As regarded efficiency of steam-raising plant at gas works, he could say, from his own experience of boilers, that, without exception, they were the last word in modern equipment and efficiency. The figures given in the paper by no means did the gas-works boiler justice. This equipment was identical with that recommended to, and largely adopted by, many hundreds of clients who went to the London Coke Committee for advice. As to the firing of coke breeze by means of mechanical stokers, the author had nothing to say; but the fact was that outside the gas industry, and to a large extent inside, coke was being fired under water-tube boilers by mechanical stokers. According to the electrical papers, coke-fired power stations were the most economical in fuel consumption. His own experience was that coke breeze was neither plentiful nor cheap. Every pound that could be saved as the result of this paper could be readily sold outside at a good price. He would point out that the CO_2 content of the flue gases was itself no complete criterion. This figure, without a knowledge of the outlet temperature of the flue gases, was quite incomplete, and very often gave an unreliable basis on which to judge the efficiency. The author had nothing to say about the advantages of balanced draught. This went a long way towards maintaining the efficiency of the boiler and eliminating the trouble which apparently Mr. Andrews had experienced through dust getting into the boiler flues. The President had referred to the sloping bridge. Now this, in his (the speaker's) opinion, was an appliance that in any circumstances, whatever the fuel used, was very desirable in a Lancashire type boiler. The Federation of British Industries had carried out very complete tests with and without this bridge, and the results were available to any members of the Association whose companies were affiliated with the Federation.

Mr. W. NEWTON BOOTH (Woolwich Arsenal) said he happened to be particularly interested in the question of fuel efficiency, because he was responsible for the running of some two hundred boilers. He knew something of what Mr. Andrews had been doing, and had a good deal of admiration for the work already accomplished. He would like to join him in impressing upon the members the importance of the human factor in securing fuel economy with boilers. A stoker, if he really understood his job, could save more than CO_2 recorders, charts, pyrometers, and such things, ever would do. By the aid of the

instruments with which every modern boiler-house should be fitted, he could keep the plant working at its maximum point. There was a mathematical error in the paper, where the author said, talking of the V notch meter, "the amount of water passing being proportional to the height in the notch." It was proportional to the $\frac{5}{2}$ power of the height of the notch. Had the author any experience of some of the many makes of CO_2 recorders now on the market? He talked of those which effected a number of analyses; but there were also instruments by which the amount of CO_2 was recorded continuously. The "W.R." was one type, and another was the "Shakespeare" instrument of the Cambridge Scientific Instrument Company. He had been struck with the remarkable accuracy with which they checked with analyses taken at the same time.

Mr. P. L. W. WOOLLEY (Croydon) said he would have liked to hear more about water-tube boilers. He also asked what percentage of steam was used in forced draught.

Mr. W. T. KENSHOLE (Lea Bridge) said he was pleased that some people believed low-grade fuel could be burned without forced draught. Most of them, he thought, found they had to have it. With reference to losses due to improper draught control, there was no mention made of cracks which might occur in the settings. The pointing-up of these cracks was very important.

Mr. ANDREWS, in reply, said there were a number of good CO_2 recorders. He had used the Simmance-Abady and the "Sarco." The CO_2 recorder should be housed, and kept quite apart from the stokers. They had the inclined bridge in one boiler-house, and he thought they ought to have more of them. It was a well-known fact in the gas industry that the boiler-house took second place. Mr. Frost had referred to getting rid of the dust; but with the advent of the very efficient forced draught furnace, he (the speaker) did not think they need trouble very much about dust. He much appreciated Mr. Nicol's contribution to the discussion. Balanced draught was a very important point to attend to. In his paper, of course, he was only speaking of boiler plants inside the gas industry, not outside. As to steam used for forced draught, in one type of furnace he had found it came to 7 p.ct. of the total steam output of the boiler, and with another class of furnace (about the latest on the market) the consumption of steam was 6 p.ct., with breeze. As to cracks, if the dampers were operated as they should be, with forced draught, very little air could leak into the settings.

PUBLIC LIGHTING.

By E. BURKE, of Accrington.

[A Paper to be read before the Manchester and District Junior Gas Association, at Nelson, on Jan. 13.]

The art of successful public lighting is aptly embodied in four essentials (which will repay careful study) laid down by Dr. J. S. G. Thomas, of the South Metropolitan Gas Company. These are: (1) Adequacy of illumination provided, (2) steadiness and constancy of the light sources, (3) absence of glare, and (4) cost to be the minimum compatible with the provision of adequate service. Previous to 1914, lighting authorities had given serious attention to the first three heads; the last one being somewhat neglected. The consequence was that many towns had attained a standard of lighting that reflected creditably on all concerned —the ingenuity of the gas industry competing successfully with the latest forms of electrical enterprise.

During the war period, everyone's business was, in his own opinion, the hardest hit by the restrictions imposed by a despotic government, but looking back, now that all restrictions are removed, I think it will be conceded that no utility service was so disorganized and disrupted as the public lighting departments of our various towns. The public have become so inured to doing without it that, even now, it is only in a very few instances that public lighting has reached anything like its pre-war conditions. Many towns continue—owing, perhaps, in no small extent to false economists—to be served with a skeleton of the formerly splendid service, when it was generally admitted that, for public service, a gas street-lamp was as good as a policeman.

WHAT IS DONE IN BIRMINGHAM.

Perhaps it will not be out of place here to give the following illustrations, which came under my personal notice, of how the advancement of public lighting was directly affected by the war. In common with many other large towns, Birmingham (where for a number of years I was fortunate enough to be employed in the public lighting service, and of whose system I am giving an account to-night) had a series of thoroughfares set aside for experimental purposes. In one of these, centrally hung high-pressure "arc" lamps, complete with traversing and raising and lowering gear, safety device, and control valves, were the order. In others, the squares and island junctions of the first-class streets had 1500 to 4500 C.P. high-pressure "arc" lamps on 30-ft. columns with swan-neck adaptors. In another case, islands were built in the principal thoroughfares opposite the cross roads; and on these islands were columns supporting three Sugg's "Littleton" low-pressure lamps—the two bottom ones with plain globes, and the higher and middle one with a ruby globe. These were "safety first" traffic regulators, and were designed to replace a policeman on point duty; the cost of lighting being saved many times by the reduction in the number of police.

The idea was this: According to the bye-laws, all traffic had to pass to the left of the island; and as no two vehicles could pass the island on the same side at the same time, there was a great slowing-down of traffic to allow the vehicle with primary right-of-way to pass. Again, all traffic from the by-roads had to come square on to the main thoroughfare and then turn, practically at right angles—a thing impossible at high speed. As I remarked, these were only in the experimental stage when the war descended upon us; and all were swept away, and have not been re-introduced in their entirety.

The city, which has approximately 22,000 public lamps and 220 lamplighters, consists of an inner circle with all hand-lighted lamps and an outer circle with lamps automatically lighted. In the inner circle, which comprises the heart of the city, the first-class thoroughfares have, situated at the corner of all cross roads, ornamental columns with circular bucket-shaped lanterns (known as specials), containing a six-light 480 C.P. low-pressure inverted cluster burner about 15 ft. above ground level, and similar columns and lanterns, but with a four-light 320 C.P. inverted cluster burner, as intermediate lights—the distances apart varying from 35 to 40 yards diagonally. Secondary roads have the four-light cluster burners at the cross roads, with two-light 160 C.P. inverted burners in square wind-proof lanterns (known as ordinaries) on columns 10 ft. high as intermediate lights—the distance apart being 40 yards diagonally. The connecting or by-roads have one-light 60 C.P. upright burners in square lanterns on 10 ft. columns, spaced 50 yards apart diagonally.

The outer or suburban circle roads are lighted and extinguished by Gunning's controllers. This controller was chosen after exhaustive tests with most of the known makes, as having the distinct advantage of requiring very little understanding, which will appeal to all who have to deal with the average lamplighter. It is compact, suitable for any make of lantern, cheap to maintain, has few parts to get out of order, gives no explosion upon lighting or extinguishing (as does the rapid lighter), and is not so liable to jam in the plug, as are many other varieties.

The tram routes have two-light upright burners in square lanterns at corners and tram stopping-places, and, as intermediates, one-light upright burners. Practically all other thoroughfares have one-light upright burners, 50 yards apart. It is only in the out-of-the-way suburban roads that the 50 yards rule is ignored. Then the distance is usually 100 yards, to allow for future closing-up by dropping an extra lamp between the existing ones. All corner lamps contain an opal tablet, on which—in blue letters—is the name of the thoroughfare at the junction of which it stands. The lamps are numbered to commence at unity in each road, and not progressively, as in many other towns. The gas consumption is estimated by the average meter system, the number of meters being one to every twenty lamps.

These two circles are formed into divisions which are subdivided into lamplighters' districts. Each division is in charge of an inspector who is responsible to the Lighting Superintendent, and contains an assembly depôt which has an inspector's office, a lamplighter's messroom, and a lamp repairing shop.

The lamplighter's district consists of approximately 120 lamps; the radius being about 2½ to 3 miles in extent. The time allowed for lighting is 1¼ hours; the lighting time being so fixed that it is completed one hour after sunset. For extinguishing time, each lighter has what is termed a "signal lamp" allotted to him. This is a lamp on another lighter's district, which he must extinguish to show that he has turned out. If the signal lamp is not extinguished, it is the duty of the lamplighter on whose district it is to call the other. The signal lamps are arranged near the beginning of each district, so that, even if a man oversleeps himself, he is never more than twenty minutes or so late. In the inner circle, the lighting would be wasteful if continued at full all night. To obviate this, a number of youths, known as checkers, commence at 11 o'clock and extinguish four lights of the six-light clusters and three lights of the four-light clusters. The number of lamps given to each youth is so arranged that the operation occupies one hour, and is completed at midnight. The remaining lights are extinguished in the usual course at dawn.

The duties of the outer circle, or auto., men vary little from those of the inner circle men. Here, each district consists of about 170 lamps, all of which are wound and set during Mondays and Tuesdays; the alteration in lighting and extinguishing times being 15 minutes each week. The clocks are set to light 45 minutes after hand-lighting commences, and to extinguish at the time of commencing hand extinguishing. There is thus about one hour per day gas saved in lighting and extinguishing; but against this must be set the bye-pass consumption.

The auto. men do their own maintenance work, change broken lamps, defective burners or clocks, replace mantles, &c. The maintenance of the inner circle is performed by special men. The lamplighters report any defect on their district after extinguishing time. These defects are entered on sheet No. 1 by the divisional inspector, and are forwarded to the report clerk at the central office. The central office in shape is like the letter "U," one leg being three stories high, and the other two storeys. The two-storey leg consists, on the ground floor, of lamp inspector's office, messroom, and stores. Above these are the superintendent's office, test room, general office, and carpenter's shop. On the three-storey-leg ground floor are the engine room, paint shop, and blacksmith's shop; while above these is the middle shop, and over that again the top shop. I will endeavour to show briefly how each fits-in to make a complete whole.

GENERAL OFFICE.

In describing the work of the general office, I shall also be describing the daily routine of the maintenance men, as one works

directly from the other. The whole of the city is divided into chimney changing districts; it being found cheaper to replace a dirty chimney with a clean one by a maintenance man, than to allow the lamplighter to clean it *in situ*. This is done after 300 hours' burning.

These districts consist of 60 lamps, and are copied from the district book on to sheet No. 2, and given to a maintenance man on his arrival at 7.30 a.m.—his basket having been filled the previous night with 60 clean chimneys. He exchanges these according to the list, bringing the dirty ones back to the works. This occupies from 1½ to 2½ hours, according to distance. While he is on this work, the daily defective reports have arrived from the divisional offices. The report clerk transfers the maintenance work, burners, mantles, &c., on to sheet No. 2; and "knocked-downs," defective taps, escapes, &c., go as specials to the pipe fitters.

Upon the maintenance man's return from chimney changing, he is given sheet No. 2, and his basket of necessary mantles, chimneys, and burners for the daily defects, which occupy him for the rest of the day. At 4.30 p.m. he returns his work sheet to the clerk, and has to report the reason for any unaccomplished work, and return the loop of the upright mantle, the clay ring of the inverted mantle, and the unused mantles, to balance the number given out with his work list. The maintenance man must see that the air-vent hole in the governor, the nipple, and burner-head are clean at every visit. All mantle dust is kept in a separate box, and returned to the stores.

Every lamp in the city has the double page of sheet No. 3 allotted to it as its life-recording sheet. On this sheet is entered everything that appertains to its peculiar lamp; the report clerk filling in from the returned sheet No. 2 all the necessary particulars. These sheets were originally in bound book form; but it was found that one lamp would have a whole page filled, while another would perhaps only be about half-filled. So now they are in loose-leaf binders; and, as they are filed in alphabetical and numerical order, it is only a matter of a few seconds to turn-up any individual lamp for reference. The police are instructed to obtain any information regarding street accidents which result in lamp damage, and are given an honorarium upon reporting the particulars to the report clerk.

Test Room.

In the test room are performed all the operations whereby financial success or failure of the lighting depends. A reliable staff of testers giving due attention to their work can pass the burners and mantles through quickly, and with a minimum of errors. The fittings of this room comprise two Parkinson's 10 c.ft. standard test holders, three rails (each with a 1-12th c.ft. test meter), minute clock, calorimeter, 10-candle bar photometer, mantle-breaking machine, and mantle and nozzle gauges.

The Birmingham Upright Burner.

With your permission, I will call attention to the Birmingham upright burner, which was the invention of the late Superintendent, and is not common to any other town. This proved so effective from a mantle maintenance standpoint, that inverted lighting was held-back for a longer period than would otherwise have been permissible; and it is at present used extensively in the by-roads—particularly in the outer circle. The governor is of the diaphragm type, and is very effective over a wide range of low pressures, from 10-10ths to well over 50-10ths. There is very little to get out of order (the war gas had a tendency to dry the diaphragms); and, with the exception of requiring new diaphragms every third year, it is practically indestructible.

The burner itself consists of a tripod with steel springs supporting the mixing tube, which is bell-shaped and terminates with a steatite head of careful design. The head contains three rows of holes, each row being out of plane with the others. The outer row consists of 32 holes, the middle row 24 holes, and the inner one 18 holes. The number and angle of moulding was decided upon after exhaustive tests.

The burners and governors are brought from the middle shop to the tester. The governors are tested at three pressures—15-10ths, 25-10ths, and 35-10ths—to see that they are functioning properly; the rejects (about 0·1 p.ct.) being opened for inspection. The burners are then assembled; and, though a skilled man does the assembling, there is nothing that could not be done by a youth. The tester sets the nipple to pass the pre-determined quantity of gas, which, again, must not at three pressures vary more than 0·05 c.ft. An increase of this amount per burner per hour means about 5,000,000 c.ft. added to the leakage account. When once set, the maintenance staff are not allowed to use any metal instrument for cleaning the nipple, but are provided with a stiff bristle brush for the purpose. Each tester will correctly account for burners at the rate of five per hour, and three testers are continuously employed on this work.

Mantle testing also is done in this room. A mantle of each of the intermediate and universal sizes was chosen as a standard. Metal gauzes were made to fit accurately over the mesh, and mandrils turned to fit the clay ring and lugs. When specifications are issued for the purchase of stores, it is definitely stated that all mantles purchased must pass the requisite gauges.

To give an idea of the importance of this procedure—particularly if estimates are prepared based upon gas consumption, or guarantees given for a definite candle power light—I have two mantles for your inspection, together with a set of mantle gauges. These mantles are both No. 2 size; but imagine, when once the burner is set for the flame accurately to fit the smaller mantle, the effect of its being replaced by the larger. We had cases where two mantles of reputedly the same size were taken from samples submitted, and to fill one required 30 p.ct. more gas than the other; or, alternatively, with a similar amount of gas the light was reduced by nearly 20 p.ct.

The burner nozzles were similarly standardized to gauges, and samples proved how necessary this also was, as it would be no uncommon thing to leave a burner without a mantle, owing to the ring absolutely refusing to go over the burner nozzle. Upright mantles which varied from the extremely wide ones that swing on the prop and cause that offensive fluctuation in light, to those that are too tight to fit over the burner-head, were rejected as not fitting accurately the standard mandril. The strength test was by means of a shock machine, which gave successively vertical and lateral shocks, registering the number on a dial. The tension could be altered so that there was a gentle contact or a violent bump. For this test, samples were taken haphazard from each consignment.

Engine House.

The engine-house, which contains a 30 H.P. gas-engine for power for the rest of the works, calls for no special comment.

Paint Shop and Top Shop.

I take these two together, as they are closely allied. The colours are delivered in powder form and ground in oils in a power mill as required. The lamp columns are painted every third year (one-third each year), by gangs of labourers in charge of a painter, commencing the first week in May, and finishing at the end of September. The columns are limewashed and rubbed down with pumice, and given two coats at the base and one coat on the top portion. The centre of the city is painted to coincide with the triennial Birmingham Musical Festival.

The lanterns are painted annually; the specials in the paint shop, the ordinaries in the top shop. The season commences at Easter, and goes on until completion. As much as possible of the lanterns is dismantled and pickled in a hot solution of potassium hydroxide, so as to remove all the old paint before repainting. The lamplighters are responsible for changing the ordinaries on their own districts; the specials are changed from the works. To allow a lantern to be exposed to the action of the weather for a longer period than twelve months was proved to be false economy, as once a lantern commenced rusting, no subsequent remedy seemed effective.

Blacksmith's Shop.

This shop calls for little comment, except that here are the pipe fitters, who erect "knocked-downs" (which average about 400 per annum), force services, and remedy escapes. The blacksmiths are engaged making and repairing brackets, lamp frogs, and on general work.

Middle Shop.

In this shop the burners and governors for the whole of the city are made by brass finishers from rough castings. All burners brought in for any complaint go from the stores to be overhauled; governors are gutted and dipped in an *aqua fortis* pickle to remove all verdigris; new diaphragms are fitted, new springs to frames, and, if necessary, new chimney galleries; the whole being turned out as new. All special lamps, the metal parts of which are cast brass, are built-up or repaired, and the frames for ordinary lamps are made.

In this shop is a chimney-cleaning machine, which consists of a vat of strong soda water, a vat of clean water, and a drying tray. Above the vats is a double spindle driven from the shafting. On the one end of the spindle is a stiff bristle brush, slightly larger than the chimney, and on the other end a soft mop. The chimneys are brought from the stores dirty, and after a thorough soaking in the hot bath are passed along the brush while it is in motion. This removes most of the unsightly rusty stain. They are then dipped in the clean water, then passed along the mop, again into the clean water, and then on to the draining tray. After drying, they are packed in 60's in the fitter's basket, and taken back to stores to be ready for the next morning's chimney cleaning.

Stores.

These are of the usual type, with which you are all familiar, with all the incomings and outgoings accurately kept by a comprehensive card system.

Scottish Junior Gas Association (Western District).—At a meeting next Saturday evening in the Royal Technical College, Glasgow, Mr. James Hall (Glasgow) is to read a paper entitled "The Manufacture of Water Gas." For the 27th inst., a visit has been arranged to Messrs. Peebles' meter works, Bonnington, Edinburgh.

Trials of Marine Oil Engines.—A Committee consisting of representatives of the Institutions of Mechanical Engineers and Naval Architects has been appointed with the objects of carrying out tests on oil-engines and of reporting on the performance of motor-driven vessels. The Engineer-in-Chief of the Fleet has, with the approval of the Admiralty, joined the Committee. It is intended to test engines of as many representative types as possible; and it is anticipated that the first actual testing work will be carried out about April next.

LOW-TEMPERATURE CARBONIZATION AND THE THERM.

By GEORGE EVETTS, M.Inst.C.E.

In the "JOURNAL" for Jan. 3, Mr. Chaney deals with the writer's criticisms contained in the issue for Nov. 15, and takes Gas Undertaking "B" for the purpose of showing what can be saved by enriching the gas by low-temperature carbonization.

The short article referred to has prompted the investigation into the details of Gas Undertaking "B" which the writer had not previously included in his criticisms. Mr. Chaney states that the figures are re-arranged in accordance with the writer's views on over-all charges; but on inspection the figures appear to be Mr. Chaney's original figures served-up in a slightly different form, and they contain as much unsound reasoning as appears in the case of Undertaking "A." In his original article of Nov. 8, Mr. Chaney takes the total therms made of 158,857,081, and works-out the over-all cost of production at 8·31d. per therm for mixed coal gas and carburetted water gas. In the article of Jan. 3, he takes the total therms sold—viz., 144,317,027—which is 9 p.ct. less (due to leakage), and yet produces the same cost of manufacture—viz., 8·31d. per therm, which he uses as a basis for a differential. The cost of manufacture, excluding the cost of oil, is 7·46d., and the cost of oil per therm *sold* is given as 0·85d. It is obvious that if the first two figures are calculated on the made basis, the balance should likewise be on the *made* basis, and would be incorrect on the sold basis.

There is therefore an error of 9 p.ct. involved on the totals, and a larger error on the balance, when mixing the calculations on the sold and the made basis. If the figure of 8·31d. is correct per therm made, it should be 9·13d. per therm sold; and if the difference due to oil is 0·85d. per therm sold, then the cost of all other items is 8·28d., and not 7·46d. However, in order not to confuse the issue, the figures given by Mr. Chaney will be used; and whether they should refer to costs per therm made or sold will not materially affect the conclusions he erroneously draws.

In the first article, the value of oil is taken at £515,518, and in the second article at £514,518 (less value of tar). From this it is to be assumed that the value of the oil tar is £1000, which is a remarkably low figure; and one would expect the tar return on this quantity of oil to be anything from £10,000 to £15,000. However, it will be assumed that the cost of manufacture, excluding oil, is 7·46d. per therm sold, thus conforming to the figure of 0·85d. per therm sold as representing the value of the oil item. It does not follow, however, that by abolishing the use of oil the cost would be reduced to 7·46d., since the 0·85d. per therm is only the item of £514,518 divided into all the gas sold. It is quite incorrect to state that the therms could be produced at this much less by cutting out the oil. Therefore Mr. Chaney's error is in assuming that the therms could be produced without using the oil; and he has evidently forgotten that if the oil is eliminated, the therms produced are reduced to an appreciable extent. Actually the therms sold would probably be reduced by 12,800,000, or thereabouts.

Assuming that Mr. Chaney's figure of 8·31d. is correct, we get the following statement:

144,317,027 therms sold at 8·31d. cost	£4,996,976	total
lessened by 12,800,000 therms costing . . .	£514,518	= 9·65d.
Leaving 131,517,027 therms of coal and blue gas costing	£4,482,458	= 8·18d.

From these figures it is clear that 9·65d. is the cost of the therm represented by the oil; and by cutting it out we save 0·13d. on the mixture, and not 0·85d. Therefore, if we wish to sell 144,317,027 therms as before, we save 144,317,027 at 0·13d. = £78,171, not £514,518. This, of course, supplies the answer to Mr. Chaney's last query "What becomes of the £514,518; is it saved?" It certainly is saved as oil expenditure; but something else must be found to provide the therms so lost.

In Mr. Chaney's original article he dealt with low-temperature gas at 9d. and 10d. per therm, and he now reverts to 6d. At the same time he is keeping the costs of coal and water gas in Undertaking "B" at what are apparently 1921 figures. For instance, the sum of £515,518 for 14,132,779 gallons of oil is 8·73d. per gallon, whereas it can now be bought at about 4½d. In other words, gas made from oil will not cost into gasholder more than 4½d. to 5d. per therm sold. A further point is that the balance of 7·46d.—*i.e.*, the cost of everything except oil—divided over the total therms does not represent the cost per therm of blue water gas, or even the cost of blue water gas and coal gas mixed, since this figure is arrived at by taking as a divisor a number of therms which is not produced. Therefore, the correct cost of mixed coal gas and blue gas is approximately 8·18d. according to the corrected table above given.

It may appear at first sight that the cost of blue gas per therm is the cost of the oil gas per therm, less the cost of oil per therm; but the following short calculation will show the difference, by taking an extreme case.

Oil used per 1000 c.ft. (say) 3 galls. at 8·73d. (600 B.Th.U. gas).
Take 1000 c.ft. of blue gas with coke at 35s. per ton and 156 therms per ton of coke (= 52,000 of 300 B.Th.U. gas).
Coke ⅓ part of 35s. . . = 8·07d. per 1000 c.ft.
Correct cost of blue gas . = 2·69d. per therm.

Incorrect method: 1000 c.ft. of carburetted gas at 600 B.Th.U. = 6 therms.

Cost—
Oil 3 gallons at 8·73d. . . . . = 26·19d.
Coke as before . . . . . 8 07d.
34·26d.
Cost per therm with oil . . . = 5·71d.
" " " eliminating oil . = 8·07d./6 = 1·35d. per therm (incorrect).

So that although the cost of the carburetted water gas, less the oil item, is 1·35d. per therm, yet the cost of blue gas is double this (2·69d.), and to take the cost of blue gas at 1·35d. is completely wrong. In other words, the cost of coke in the carburetted gas is only the cost of the coke constituent, which is naturally half for a 600 B.Th.U. gas as compared with that of a 300 B.Th.U. gas. Oil at any price would produce the same result; but if oil were taken at 4½d. per gallon, the carburetted gas would be nearer in cost to the blue gas.

On carbonizing materials alone, however, the cost of carburetted gas would not be as low as blue gas until oil became 2·69d. per gallon. It matters not, therefore, whether Mr. Chaney concedes any difference in cost between water gas and coal gas, since the mixed gas costs are based on unsound reasoning.

In proving a saving of £655,441, Mr. Chaney is very wide of the mark, since his table takes 84·3 p.ct. of gases at 7·46d. per therm, which in fact will cost him 8·18d. if he eliminates oil.

The correct table will be—

84·3 p.ct. of water gas and coal gas at 8·18d. . . . . = 6·89d.
15·7 p.ct. of low-temperature gas at 6d. . . . . = 0·94d.
Cost of mixture per therm . . . . . 7·83d.
Original cost, 8·31d. with oil.
∴ saving is 0·48d. per therm × 144,317,027. . . . . = £288,634

In hinting at a further possible saving of the cost of oil, Mr. Chaney is approaching exactly the same kind of error as in the case of Undertaking "A." In the table as published last week, the saving of the oil is already involved in the reduction of the over-all therm cost from 8·31d. to 7·46d. So that nothing is saved on oil, as apart from the general reduction in cost; and the saving of £655,441 becomes £288,634, if the costs of production and relative cost of low-temperature gas are accepted. It does not seem reasonable to take carburetted water gas and coal gas at the high figure of 8·31d. per therm or thereabouts, unless the cost of low-temperature gas is correspondingly high.

Further, it would not pay an undertaking with a carburetted water-gas plant to purchase low-temperature gas at 6d. per therm, nor yet to put down plant in order to manufacture it at this price. Any manager in possession of a carburetted water-gas plant can to-day put a therm into his gasholder at a cost of 5d. or thereabouts, by the mere addition of oil; and this can be done without the expenditure of one penny of capital. Therefore, no system should be considered which will result in a cost of more than 5d. per therm for materials, labour, repairs, and capital, unless other considerations influence the decision. Any method which produces gas at less than this sum per therm will show a saving (other things being equal), as the proof is mere arithmetic.

It does not need a technical writer to prove that a percentage of one gas at 7·46d. mixed with a percentage of another gas at 6d. will produce a mixture at less than the higher figure, to say nothing of showing a saving on 8·31d. The skill of the technical officer must be exercised in assessing the financial and other effects of the consequential alterations due to a change of process, as well as gauging the value of the figures which are chosen as representative costs on which the alleged savings are based.

Recovering Fuel from Ashes by Magnetic Separation.

According to information that has been received by "Engineering," the German firm of Messrs. Fried. Krupp have devised a magnetic separator for recovering coke and unburned coal from ashes; and many of these machines are now in successful operation. It is pointed out by our contemporary that practically all coals contain iron in the form of pyrites, which has no magnetic properties. The burning of the coal, however, converts the pyrites into oxides which are magnetic; and as the whole of the iron passes away with the slag, the metal exists there in a very much more concentrated form than in the original coal. These facts are taken advantage of to effect the separation. The machine employed consists of a magnetic drum over which the furnace refuse is passed. The drum rotates slowly about a horizontal axis, just as in the case of an ordinary magnetic separator The ashes to be treated are delivered by a bucket elevator to a vibrating screen, which separates them into various sizes. Each size is passed separately on to the circumference of the drum. The slags containing iron are held magnetically to the surface for a portion of the revolution, and then drop off into small wagons or other receptacles as the current exciting the portion of the drum which held them is automatically broken. The coal and coke which may be present do not adhere to the drum, but leave its surface directly after contact with it, and fall into their own receptacles. It is said that lumps of slag up to 3-in. mesh will adhere to the drum, and thus be eliminated from the fuel. The fuel thus recovered can be burned under boilers by means of forced draught, or it may be briquetted. Both these methods are, in fact, in use. The agent for Messrs. Krupp in this country is Mr. W. Stamm, No. 63, Queen Victoria Street, London, E.C.

AMERICAN GAS ASSOCIATION MEETING.

(*Concluded from p.* 740, Vol. CLX.)

Meter Rating.

The Committee on Consumers' Meters, it was reported by Mr. J. Lucena, had been concerning themselves mainly with the development of a method of meter rating in cubic feet per hour. The system of rating meters suggested was (say) 5-100, 30-330, &c.; the first figure referring to the number of lights served by the meter, and the second indicating the cubic feet per hour rating of the meter. These ratings would appear on the meter badge. The Committee had considered it unwise and inexpedient to recommend the standardization of meter construction design, on the ground that it would tend to discourage improvement and further developments in this direction by the manufacturers.

Industrial Fuel Outlook.

An optimistic note was struck by Mr. F. F. Cauley (the Chairman), in reporting on behalf of the Industrial Fuel Committee. One of the Committee's recommendations was that architects and engineering firms should be encouraged, by closer contact, to recommend gaseous fuel to their clients. Once they knew the possibilities of gas in the factory, these men would prove assets to the industry. In their opinion, the lack of knowledge as to what can be accomplished with gas when properly applied, has done more to retard progress than anything else. For example, how many men in the commercial departments, they ask, know how much gas can be sold to the various industries in their respective localities, and how much is needed for different operations? They referred to the cooperage industry, and said that tests at several plants in the West show that a 16-gallon barrel can be dried with 8 c.ft. of gas, and a 50-gallon barrel, weighing 85 lbs., with 16 c.ft. of 535 B.Th.U. gas. Their view is that there never was a time in the history of the gas business when the sale for industrial purposes was so encouraging. The business depression following the war is over, and manufacturers are all looking for better heating methods. Architects and consulting engineers are busy drawing-up plans for new factories and heating equipment; and there has been a marked increase in the number of firms manufacturing industrial heating plant. There are also many other activities, all tending to show business revival, which indicate the great opportunities ahead of the industry for the next few years.

The Water-Heating Field.

Figures to show the immense field existing for the extended use of water-heaters in the United States were submitted by Mr. C. E. Bartlett, of Philadelphia, who said the latest available statistics indicate that there are in use 9 million meters on manufactured gas, of which probably 8 million are in connection with domestic supplies. There are 7 million gas-ranges in use; and if 87 p.ct. of the present meters are already serving cooking appliances, the increase in revenue to be derived from the sale of additional apparatus of this character must be small. On the other hand, there are not quite 1¼ million water-heaters employed, which figure includes all types. Here, then, is an answer to the question "Whence is the increase in gas sales to be derived?" Never has so promising a situation for increasing sales existed.

Accounting in Small Gas-Works.

In the course of a paper in which he explained in detail various systems of accounting, Mr. W. G. Murfit, of Newtown, said the Consumers' Accounting Committee issued a questionnaire to companies, and only 16 p.ct. of those replying are using bound ledgers. From their answers, it is evident that even this percentage will be reduced in the near future. The largest number are using loose-leaf ledgers, with card ledgers ranking second. To his mind, there is little to choose between the two.

With most companies the procedure is as follows: The prospective customer signs an application for gas, whereon are printed the usual rules of the company. The clerk writes-up the work order, usually in duplicate. This work order may have been designed for meter work only, or it may be a form which is used also in merchandize work. The work orders are numbered serially as issued, and the work order number is placed on the application. These applications are then filed away alphabetically. The work order is usually printed in duplicate, or in triplicate in the largest of the small companies. One copy remains in the office, and the other is given to the fitter to do the work. The meter order—*i.e.*, the work order—is returned to the office, and a ledger page or card opened in the consumer's name. The completed meter order is then filed in order of date of completion. It is at this point that the addressograph plate should be made, though sometimes the plate is made before the meter order goes on the street. If meters are read from meter-reading books, a page for that is also made out at this time. It is unnecessary to state that the meter company number, the meter manufacturers' number, the date, and the index are posted to both ledger page and meter-reading book.

Some companies do not have a meter-reading book, using instead the gas bill itself. This gas bill is printed with one or two coupons attached. These are first addressographed; the addressograph plates being in the order in which the names appear in the gas ledger. The previous index and date are placed on the bill and coupons, and any outstanding balance, either gas or merchandize, is included. They are then given to the meter reader to take on the street. He reads the meter, makes the subtraction, obtains the charges from a prepared schedule he has in his hand for each unit of 100 c.ft.—thereby avoiding any calculation on his part—and leaves the bill on the premises. He writes all data on both the bill and the coupon, and in a few cases attempts to collect at the same time.

Rates for Large Consumers.

It was urged by Mr. Carl D. Jackson that for large consumers of gas a schedule based on an analysis of cost, in which "customer" and "output" or "commodity" costs are separated, would reflect in its "commodity" portion most, if not all, of the variable elements of cost. Considerable attention has, he said, been paid in recent years to the matter of securing rate schedules which could be automatically adjusted as certain bases of prices fluctuated. In the electricity business, schedules of power rates in which the energy component varies with the changes in the cost of coal, are not infrequent. In some, variations in the cost of labour have also been introduced. There is much to be said in favour of such automatic adjustment features in schedules of rates for gas service for large consumers.

Customers who are in a position to understand thoroughly the nature of the schedules on which they purchase service, and the significance of the different portions of the schedules, will usually recognize the fairness of having the "output" portion or the commodity price vary with certain determining factors. The cost of gas coal or the cost of oil, or some combination of these, with the average cost of labour when properly related to their effect upon the "commodity" portion of the rate schedule, may properly serve as the basis for automatic adjustment. In the electric power business, such automatic adjustment has been very satisfactory, in many cases, because rates increased or decreased much in the same manner as the cost to the customer of supplying his own power service would have increased or decreased. The relation of the "commodity" portion of these rate schedules for large customers to such elements as the cost of gas coal or gas oil, may not afford as completely satisfactory a basis for automatic adjustment as has been found in the electric power schedules; but probably in most cases the fluctuation of the "commodity" portion of the rate with such elements as the price of gas coal or gas oil may, in the long run, be more satisfactory than adjustment of the rate by direct order of a regulatory body in each case. Where the rate fluctuates immediately with, or closely following, fluctuation in basic prices, increases and decreases in the cost of his gas service are more likely to accord with the customer's ability to pay than they will if such increases and decreases have to be delayed until definite action can be taken by a Regulatory Commission to fix a new rate. Furthermore, in most cases such rates seem to appeal to the customer's spirit of fairness.

New Committee Work.

In addition to what it has been possible to notice here, numerous Committees submitted reports to the convention; and their work is to go on during the next twelve months. It was decided to continue the Committee on Carbonization and Complete Gasification of Coal. They will keep in touch with research work being conducted by Prof. Demorest at the Ohio State University. The Consumers' Meters Committee will also be continued, with Mr. Walton Forstall as Chairman. Their task will be to submit a definite recommendation as to a standard capacity rating for consumers' meters, and, once an agreement has been reached, to secure action by the Executive Board adopting the report of the Committee as a standard of the Association. Full co-operation of the manufacturers of consumers' meters is to be obtained in this work, and in the work of making the standard effective. The Work of the Distribution Design Committee was discussed, and the following suggestions as to activities were submitted: To take existing distribution systems, work them out on a valuation basis, and compare them with an "ideal system;" to consider the problem of converting older systems into the ideal system; and to give consideration to the relative merits of outlying storage, use of compressors, &c. The Sales Stimulation Committee will continue to initiate definite sales plans and activities for the guidance of company members. To stimulate interest in sales per meter per year, it was proposed to offer a suitable prize or prizes to the company making the best record of merchandize sales for the year. A Committee on Co-Operation with Architects and Builders were appointed, to bring about closer co-operation between architects, plumbers, and the gas companies. A Committee were also appointed on Co-Operation with the Plumbing and Heating Dealer, to bring about the same relationship in these allied fields as will be attempted with the architects.

Midland Junior Gas Association.—At the Council House, Birmingham, on Thursday evening, Jan. 18, a paper will be read by Mr. J. W. Wood, M.Sc., Research Chemist to the Gas Investigation Committee of the Institution of Gas Engineers, on "Recording Calorimeters." At the meeting, the Council will suggest a reduction in the subscription for the current session from 12s. 6d. to 10s., inclusive of a copy of the "Joint Junior Association Transactions."

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Cast-Iron or Steel Mains.

SIR,—There is some danger of the carbon monoxide scare receiving an impetus from the accident which has occurred at Bethnal Green; and this would seem to be an opportune moment for inquiring what really is the cause of such an appalling disaster—probably the worst case out of many similar.

Much trouble and consideration was given at the inquest on Jan. 4 to the framing of the verdict; and it was issued in its final form in fairness to the Gas Company. A "broken main" is always taken for granted at inquests by everyone concerned, and in this case the technical reason assigned for breakage was that the main was laid across some brickwork. Surely this is neither creditable to the gas industry generally nor reassuring to the public. May I suggest a further slight alteration to the verdict, which would still be perfectly fair to the Gas Company?

"That the deceased persons died from coal-gas poisoning caused by gas escape from a fractured main-pipe in the roadway, and that the pipe, though laid in 1880 in a manner involving no neglect at that date, fractured *on account of its having been made of brittle cast iron*."

I will not suggest a rider, but would like to ask the same two questions as I have asked before:

(1) If steel mains had been available in the early days of gas engineering, and if the use of them had become standard practice, is it likely that the Board of Trade, or the engineering profession, or public opinion, or any other creature, would tolerate for one moment the passing of an inflammable and asphyxiating gas under the traffic of our modern streets and roads in *breakable* pipes?

(2) If steel mains are good (perhaps essential) for high pressure, why not for low pressure?

B. R. PARKINSON.

Cottage Lane, City Road, London, E.C. 1, Jan. 5, 1923.

The Fivepenny-Halfpenny Therm.

SIR,—Referring to your editorial note on "The Bath Therm" in the current issue of the "JOURNAL," the price of gas here was reduced to a flat rate of 3s. 4d., less 10d. discount if paid within a month, or equal to 2s. 6d. per 1000 c.ft. net, as from the last meter readings (December quarter). As the calorific value of the gas supplied is 550 B.Th.U. gross, the net price is equivalent to 5·45d. per therm.

Corporation Gas-Works, Middlesbrough, Jan. 4, 1923. CHARLES F. BLINCOE.

SIR,—I enclose herewith copy of a letter I have directed to the Engineer and Manager of the Bath Gas Light and Coke Company, in reference to the price of gas at Bath and Widnes.

Corporation Gas and Water Works, Widnes, Jan. 4, 1923. CHAS. E. DICKINSON.

[ENCLOSURE.]

Gas and Water Works,
Widnes,
Dec. 18, 1922.

J. Wesley Whimster, Esq.,
Bath Gas Light and Coke Company.

DEAR SIR,—I note from yours of the 15th inst. that the price of gas to consumers in Bath is to be 5½d. per therm from Jan. 1 next, which, I think, you anticipate is below the Widnes price.

Inquiries elicit the information that Bath has no differential price for large industrial consumers nor for motive power and industrial furnace consumers, as is the case with Widnes; also that Bath charge their prepayment consumers 10d. per 1000 c.ft. more than ordinary, against Widnes 4½d.

The Widnes prices are as follows:

	Per 1000 C.Ft. s.	d.
Domestic consumers	2	3
Industrial consumers—		
When annual consumption is under 3,000,000 c.ft.	2	3
All over 3,000,000 c.ft.	2	1
Motive power and furnace purpose consumers—		
When annual consumption is under 500,000 c.ft.	1	11
500,000 and under 1,000,000 c.ft.	1	10
1,000,000 ,, ,, 5,000,000 c.ft.	1	9
5,000,000 ,, ,, 10,000,000 c.ft.	1	8
10,000,000 ,, ,, 20,000,000 c.ft.	1	7
All over 20,000,000 c.ft.	1	6

Having regard to the anomalistic prices in Widnes, it is safe to assume you agree that the average price obtained by each undertaking is the only fair basis for comparison.

To this end, I have ascertained that the present average obtained by Widnes is 1s. 11¼d. per 1000 c.ft., or 4·84d. per therm (the calorific value of the gas supplied being 480 B.Th.U. gross), which is 3·15d. per 1000 c.ft., or 0·66d. per therm, less than the Bath price of 2s. 2·4d. per 1000 c.ft., or 5½d. per therm.

This represents a comparison of the average price obtained from domestic, large industrial, and motive power and furnace purpose consumers; no consideration having been taken of the price obtained from prepayment consumers. It will already have been observed that Widnes charge 5¾d. per 1000 c.ft. less to this class of consumer than do Bath.

I note with concern that you have always striven to out Widnes in the price of gas; and as Widnes strives to maintain its proud record of having supplied the cheapest gas in the world for the past quarter-of-a-century (with the exception of a short period when undertakings on the North-East coast obtained exorbitant prices for coke to the exclusion of Widnes), we may hope to hear of each other in the future.

Yours faithfully,
(Signed) CHAS. E. DICKINSON.

Selling Gas "By Volume of Declared Quality."

SIR,—With deference, I join issue on your note appearing on p. 37 of this week's issue, assuming your correspondent to have inadvertently used the word "stated" instead of "declared."

Section 1 of the Gas Regulation Act enables Orders to be made for power "to charge for thermal units supplied in the form of gas;" and even if calorimeters were fixed in all consumers' premises, we should still require (and probably always shall require) registration by volume. "Charging by the therm" is but inferential after all, for therms shown on the gas bill and therms actually consumed represent different quantities of heat, just as if the charge were made by "volume of declared heat content."

Everyone agrees that a consumer charged only at "so much per thousand cubic feet" has no information of the price paid for heat, and consequently no means of comparison—a detriment to consumer's and undertaking's interests alike.

If the consumer has used (say) 42,200 c.ft. supplied at the declared quality of (say) 475 B.Th.U. per c.ft., at the price of (say) 9d. per therm, the equivalent charge for this 4·75 gas (4·75 therms per 1000 c.ft.) is, of course, 3s. 6¾d. per 1000 c.ft. If the demand note be made out in accordance with the Act's requirements, it would show:

"42,200 c.ft., or 200·45 therms at 9d. . . . . = £7 10 4"

But the consumer would still require, for "home" and "foreign" comparison, (and yet be short of) the "price per thousand."

There is no apparent reason why demand notes cannot be made out in this way:

42,000 c.ft. at 3s. 6¾d. per 1000 c.ft. . . . . = £7 10 4.

This Company's (Corporation's) gas is declared to contain 475 British thermal units per cubic foot; and the price charged per therm (per 100,000 heat units) is at the rate of 9d. The quality supplied is independently tested and supervised.

Probably not 1 p.ct. of gas consumers will ever be able to think or reason in terms of therms, but the information would nevertheless be at their disposal on the demand note; and though the form of account may perhaps not absolutely comply with the Act's verbal requirements, it might be accepted as such, for it appears to give effect to every principle and intention. It is certainly less laborious for consumers and undertakings, and, as only those responsible for office management know, very much less costly in clerical labour (for which, of course, the consumer pays). Above all, it can easily be assimilated by the public, and, so far as I can see, provides no loophole, because selling gas by "volume of guaranteed heat content" affords the consumer the same protection as selling by "the therm." It is, in fact, the same rose under a different name, but cannot possibly mean "simply going back to the condition of things that existed before the passing of the Gas Regulation Act"—*declared quality being unknown at that time.*

I hope you will agree that there is no abandonment either of economic concessions or liberty of technical progress to the industry in selling gas by "volume of *guaranteed* heat content" instead of by "the therm."

Liverpool, Jan. 8, 1923. EDWIN UPTON.

SIR,—Referring to your editorial comment on Mr. Higham's very common-sense letter in your issue of Jan. 3, have you not entirely misrepresented the situation?

Is not a "stated quality" the same thing as a "declared calorific value," and why should "declarations" be abandoned because gas is charged for by the cubic foot?

In another part of the same issue, you state that accounts are likely to be rendered in future with the alternative of the cubic foot charge. Do you anticipate that such action will lead the authorities to adopt a new policy?

Finally, you state that the liberty to declare is bound-up with the therm basis of charging. This is simply not true. If you had said the thermal basis of *supply*, with all its accompanying safeguards for the consumer, that would have been correct; but, from the consumer's point of view, there is not the slightest reason why all the advantages of the Gas Regulation Act should not have been secured without any alteration in the method of rendering accounts.

26, Muncaster Road, Clapham Common, S.W., Jan. 6, 1923. ARTHUR CUNNINGTON.

Total Gasification and the Tully Plant.

SIR,—I must congratulate Mr. N. Sampson Smith, B.Sc., of Ossett, on his paper [see "JOURNAL" for Dec. 20, p. 736], though he does not seem to be aware of the fact that many important improvements have been made in the Tully plant since it was erected at Ossett, and that this plant was one of my first attempts at complete gasification of coal.

I will not go into full details of the improvements that have been made, but will leave the matter, with the hope that someone will come forward with an up-to-date paper on the subject. I would, however, mention that the latest design of plant gasifies the whole of the tar and produces a gas of at least 40 to 50 B.Th.U. more than by the old process. In fact, it converts Mr. Smith's 5 gallons of tar of 835,000 B.Th.U. into gas, which would, in his case, bring the 333 gas up to 350 B.Th.U.

I would like Mr. Smith to make another test using a standard coal, and then prepare another paper after the plant had been altered to the new method of working. This would certainly be of interest, and would mark the progress made within the last three years. For the

tests to be of any practical use, the plant should be fitted with air and steam meters and pyrometers. A standard coal of uniform quality should be used for testing purposes, so that comparison can be made with the working of other plants on the same coal.

I would mention briefly some of the principal improvements that have been made:

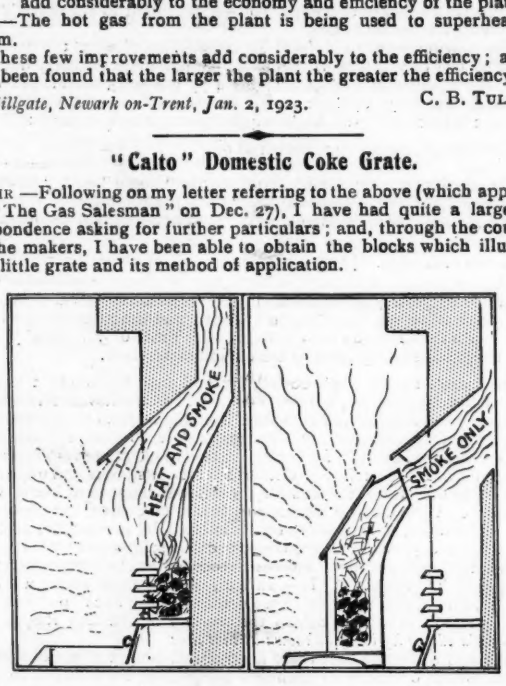
1.—The coal gas generated in the retort passes down the retort, meeting the water gas at the nostrils, and passes with it through the chequer chamber, where it is fixed into permanent gas—the reverse of the case with the Ossett plant.
2.—The retort is longer, and the fuel bed shallower.
3.—The grate is of mushroom shape, designed to concentrate the blast into the centre of the producer.
4.—A carburettor has been added to the plant for the use of oil for enrichment and further fixing the coal gas.
5.—A waste-heat boiler of simple design has been added, which produces the whole of the steam necessary for blowing and steaming the plant.
6.—"Thermonite" retorts and linings are in use, the conductivity of which is five times greater than fireclay, and has been found to add considerably to the economy and efficiency of the plant.
7.—The hot gas from the plant is being used to superheat the steam.

These few improvements add considerably to the efficiency; and it has been found that the larger the plant the greater the efficiency.

Millgate, Newark on-Trent, Jan. 2, 1923. C. B. TULLY.

"Calto" Domestic Coke Grate.

SIR,—Following on my letter referring to the above (which appeared in "The Gas Salesman" on Dec. 27), I have had quite a large correspondence asking for further particulars; and, through the courtesy of the makers, I have been able to obtain the blocks which illustrate the little grate and its method of application.



I find that some people who have tried them claim that they have cured smoky chimneys, even when using coal. This is quite possible; but I think it as well to mention that it may be necessary in some cases to restrict the fireplace opening by means of an asbestos slate or sheet of metal. This will ensure sufficient draught. The makers inform me that they have discarded firebrick lining, and showed me a grate that had been in use for three years, and appeared to be as good as when first put to work. I was interested to learn that the inventor was a Leeds man; but judging from his name, I imagine that he or his ancestors came from farther North.

Most of us are familiar with the coke fire made in a bucket which has been pierced with a pick; and the "Calto" grate seems to be a refinement of this principle for domestic use. The fact remains that it is highly efficient and very comforting. The glowing fire is most attractive, and the surface exposed per pound of fuel which gives off the very valuable radiant heat is larger than in any grate I have met with.

P. SANDFORD.

47, *Victoria Street, Westminster, S.W.* 1,
Jan. 8, 1923.

Controllers for Public Lamps.

SIR,—Regarding the paper to be read by Mr. E. Burke, of Accrington, to the Manchester Junior Gas Association, on the 13th inst. [see p. 85], we must take exception to the following remarks by Mr. Burke in regard to Birmingham's public lighting:

> "The outer circle roads have lamps lighted and extinguished by Gunning's controllers. This controller was chosen after exhaustive tests with most of the known makes, as having the distinct advantage of requiring very little understanding, which will appeal to all who have to deal with the average lamplighter. It is compact, suitable for any make of lantern, cheap to maintain, has few parts to get out of order, gives no explosion upon lighting or extinguishing as does the rapid lighter, and is not so liable to jam in the plug as are many other varieties."

We should like to point out that during the past twelve months we have supplied over 3000 controllers to the Corporation of Birmingham, in regular orders. Naturally, if, as Mr. Burke states, "Gunning's controller was chosen after the most exhaustive tests," they would not have placed orders with us for such quantities, unless they were satisfied with our controllers.

As regards the explosion of the "quick lighter," this is manifestly no greater than that which occurs with ordinary hand lighting; and with modern methods of lighting, a quick lighter is more desirable. With a slow lighter there is always an interval in which an incorrect mixture of gas and air takes place in the incandescent burner, so that if a correct mixture is obtained for a "full-on" lighting, the mixture lights back in the early stages of the operation; while if the burner is adjusted not to light-back, too strong a mixture is obtained, resulting in extravagant gas consumption and sooting of the mantle when full on.

We should be glad if you would publish this letter, to counteract any misapprehension which may arise through your publication of Mr. Burke's paper.

Newbridge Works, Bath,
Jan. 8, 1923.

THE HORSTMANN GEAR CO., LTD.,
E. C. Horstmann, Director.

REGISTER OF PATENTS.

Mixing and Proportioning Gases.—No. 181,668.

THE SURFACE COMBUSTION COMPANY, of New York, Assignees of W. B. EDDISON, of Irvington, N.Y.

No. 17,482; June 27, 1921. Convention date: June 14, 1921.

This invention seeks to provide an improved apparatus for supplying an explosive mixture of fuel gas and air to the burner discharge orifices of a surface combustion furnace at a pressure above a predetermined minimum and in quantities variable at will, without changing the proportions of the constituent gases—that is, to meet the conditions of constant proportions, variable quantity, and exit pressure sufficient to prevent backflashing.

The chief aim is to minimize the effect on the mixture proportionality of variation in resistance to outflow of the mixture and of gas-pressure variation, and to increase the permissible latitude in size ratios between the flow-controlling parts of the apparatus. The invention also has the advantage of reducing the amount of pressure air required and of lessening the effect of slight inaccuracies in the apparatus. The method employed and the principles involved are discussed at length in six pages of text; the patentees claiming:

1. Apparatus for producing and supplying an explosive mixture of fuel gas and air in approximately constant proportions, comprising a nozzle for discharging a high velocity jet of air, an entraining tube into which the jet of air is discharged, means for supplying fuel gas at a relatively low pressure to the entrance of the entraining tube, and a second entraining tube mounted with its entrance cone in position to receive the jet of mixture from the first entraining tube to combine additional air therewith to form a mixture of the desired proportions; the nozzle and entraining tubes having approximately parallel sides and being of such relative cross areas that a substantial variation within limits in resistance to outflow of the mixture causes substantially no change in the richness of the mixture.

2. Apparatus as claimed above in which the nozzle and entraining tubes are of such relative cross-areas that an increase within limits in resistance to outflow of the mixture causes a slight increase in richness of the mixture.

3. A disc shutter adjustable toward and from the entrance cone of the second entraining tube to vary the supply of air; the shutter being shaped to provide with the entrance cone a rounded entrance and a passage of gradually decreasing cross-area, giving stream-like flow and gradual acceleration of the entering air.

4. The second entraining tube is formed by the throat of a venturi tube by which the resulting mixture is delivered at the desired pressure and which has between its entrance cone and its pressure cone an elongated smooth-walled entraining and velocity equalizing throat, the sides of which are approximately parallel and the length of which is sufficient substantially to equalize the velocity across the stream.

Wet Purification.—No. 169,996.

KOPPERS COMPANY, of Pittsburgh (Penn.), Assignees of C. J. RAMSBURGH, of Pittsburgh.

No. 26,472; Oct. 6, 1921. Convention date: Oct. 7, 1920.

This invention relates to the purification of fuel gases—for example, coke-oven gas—from noxious constituents such as hydrogen sulphide and other sulphur compounds, employing a liquid purifying agent and concurrently rejuvenating the latter for further use in the purification of the gas.*

The process essentially comprises the combination of steps consisting in maintaining a purifying liquid in continuous circulation through an impurity absorption stage and an aeration stage, and heating the purifying liquid delivered to the aeration stage by means of heat derived from the gas that is treated.

In its present embodiment, a form of which is illustrated and described below, the invention is applied to the purification of coke-oven gas, and, for convenience, the present description will be confined to this use of the invention. The features of the invention are, however, readily susceptible of other valuable applications.

The gas is passed through a gas line A into a scrubber B (such as an ordinary benzole scrubber) in which it passes up through a descending current of sodium carbonate solution, which effects the absorption of

* For the application of a wet purification process (of the Koppers Company) to coal gas, readers are referred to the "JOURNAL," Vol. CLX., p. 566.

the hydrogen sulphide from the gas. Passing out of the scrubber B, the substantially purified gas flows through a gas line C to iron oxide boxes, which are employed for absolute safety. However, substantially the entire content of sulphur is absorbed from the gas in the scrubber B; and little, if any, sulphur remains in the gas as it passes through the boxes. Consequently the quantity of iron oxide may be greatly reduced, and the upkeep of the boxes will involve but a small expense, as compared with present practice. Because of the basic property of the sodium carbonate solution, other acid constituents of the gas besides carbon dioxide and hydrogen sulphide will be absorbed—for example, the sodium carbonate solution will absorb hydrocyanic acid.

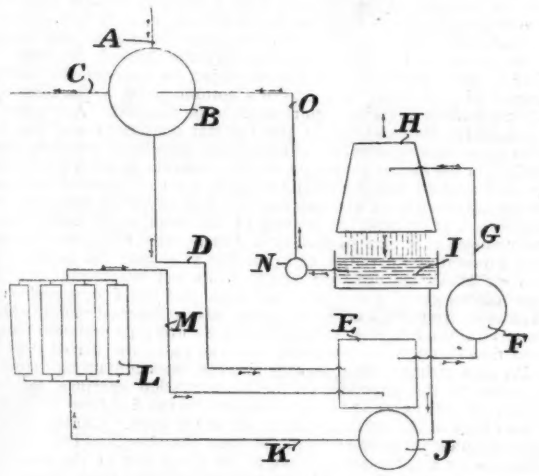
The fouled sodium carbonate solution containing the absorbed sulphur passes through a discharge line D to a hot well E, and thence is pumped by means of a pump F through another discharge line G to the top of the ordinary cooling tower H. Flowing continuously down through the cooling tower, the fouled solution is subjected to aeration caused by an upward draft of air through the cooling tower; and this aeration is effective to cause the fouled solution to give up the hydrogen sulphide and other absorbed constituents, and to become thoroughly rejuvenated and purified as it reaches the basin I underneath the cooling tower. The rejuvenation of the fouled solution in the cooling tower is illustrated by means of the following equations:

$$2NaHCO_3 = Na_2CO_3 + CO_2 + H_2O.$$
$$2NaHS + CO_2 + H_2O = Na_2CO_3 + 2H_2S.$$

And also:

$$NaHCO_3 + NaHS = Na_2CO_3 + H_2S.$$

Rapid and thorough aeration greatly accelerates the foregoing reactions, by rapidly removing the gaseous reaction products, as well as checking the formation of thiosulphate; and the fouled solution gives up its hydrogen sulphide and is regenerated. The rejuvenation process in the cooling tower may be augmented by increasing the content of carbon dioxide in the air circulated upwardly through the cooling tower. Instead of air, another similarly inert gas may be used.



Illustrating a Koppers' Wet Purification Process.

In order to accelerate the above regenerative reactions, and to increase the rapidity of aeration by causing a strong updraft of air through the cooling tower, a large quantity of the purified solution in the basin I is heated and pumped back to the hot well in which it joins and greatly dilutes the fouled solution that is flowing to the top of the cooling tower. This is effected by a pump J forcing the solution through a line K to heat-exchange means such as ordinary primary coolers L, where it is circulated in counter-current with the hot gas as it issues from the collecting main of the coke ovens. Thus the solution absorbs large quantities of heat before flowing through M to the hot well. The hot solution in the top of the tower promotes an updraft of air through the tower, with a resultant increase in the aerating effect and a greater efficiency in the rejuvenating process carried on in the cooling tower. A portion of the rejuvenated solution is pumped by a pump N through a fresh solution line O to the scrubber B, thereby maintaining a constant recirculation of solution to the purification process. In practice, the quantity of liquid flowing through the auxiliary circuit, including the primary coolers, is approximately nine times greater than that flowing through the main circuit including the scrubber.

Pressure Regulators for Gas-Mains.—No. 189,249.

MELLERSH-JACKSON, W. J., of Southampton Buildings, W.C. A communication from the Koppers Company, of Pittsburgh (Penn.).

No. 23,271; Sept. 1, 1921.

This invention relates to pressure regulators for gas-mains, more particularly the collecting mains of bye-product coking plants, in which it is of great importance to maintain substantial uniformity of pressure conditions.

Pressure-regulating devices operating on the mechanical relay principle are well known, the patentee points out. They usually comprise a member, such as a diaphragm or float, responsive to the pressure fluctuations of the fluid to be regulated, and a lever connected to a relay valve which controls a supply of fluid under pressure—preferably a hydraulic power system—feeding a double-acting motor which can open and close a pressure-regulating valve. A two-stage regulator has also been proposed, comprising a second relay between the first relay and the motor, and controlling the same energy source as the first relay; but as the valve member of the second relay is spring-operated, and the motor operates the valve under hydraulic power in one direction only (the reverse action being determined by a counterweight), this two-stage regulator could not be considered adapted for gas-main pressure regulation.

The regulator according to the present invention is multi-stage; and its characteristic feature is that the final relay has its valve member positively operated by the fluid pressure in both directions. The motor for actuating the gas-main valve is double-acting, as in several of the known single-stage regulators; hence every movement of all the power-operated parts is positive, being determined by direct effort of the fluid pressure constituting the energy source under relay control.

Another feature consists in the relay-valve member which controls the direction of motion of the motor being actuated by a differential piston, the smaller diameter part of which is subjected to the constant pressure of the power system, while its larger diameter part is subjected to a variable pressure produced from the same power system by means of a pilot valve operatively connected to the movable member responsive to the pressure fluctuations in the gas-main.

The most suitable movable member has been found to be a bell float operating in a tank, and preferably equipped with an air chamber for enhancing its buoyancy. Thereby the most minute fluctuations in pressure are transmitted to the pilot valve, and a progressively increasing effort is carried on through multiple stages to the large gas-main valve.

The invention is illustrated by fifteen drawings, and the descriptive matter extends over five-and-a-half pages.

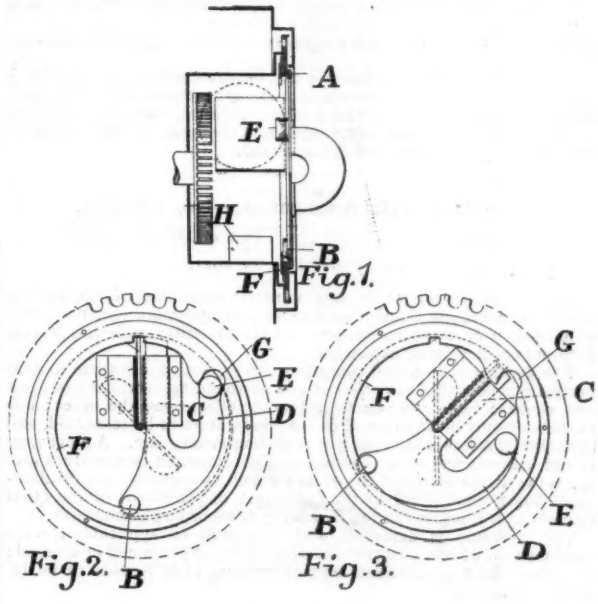
Prepayment Gas-Meters.—No. 189,722.

CANNON IRON FOUNDRIES, LTD., OLIVER, F. R., and ASTON, A., all of Bilston.

No. 14,206; May 19, 1922.

This invention has for its object to provide an improved coin carrier for use in prepayment gas-meters and the like, in which the movement of an inserted coin from one position to another is utilized to actuate a valve or analogous device. The general construction of the mechanism will be understood from the drawings, of which fig. 1 is a sectional side elevation, and figs. 2 and 3 are rear elevations of the main portion of the coin carrier showing the shutter, which is the main feature, in the inoperative and operative positions.

This shutter is arranged on the rear of the rotatable disc A. It is pivoted at B, and formed with a pair of limbs one of which C lies between the coin holder and the disc and can move over or away from the coin insertion slot, while the other D is provided with a projection



A Prepayment Meter Shutter.

E adapted to co-operate with a fixed cam ring F secured to the ring which carries the disc A.

In the initial position of the coin carrier the projection E lies in a recess G in the ring F (as shown in figs. 1 and 2) and the member C is clear of the coin insertion slot. After the insertion of the coin, the first effect of rotation of the disc A is to move the part E out of the recess G, and by its interaction with the adjacent portion of the ring F to cause it to move the part C of the shutter over the rear side of the coin slot, as shown in fig. 3. The coin holder is now inaccessible from the exterior, and tampering with the mechanism is effectually prevented. When the disc reaches the end of its movement, as determined by the abutment of the coin holder against a stop H in the case, the coin falls away from the holder into a receptacle. During the return of the disc, the slot still remains closed until the projection E approaches its initial position. A portion of the ring F then engages the projection and

causes it to move into the recess G, thereby withdrawing the part C and re-opening the coin slot in the disc A.

It will be seen from the foregoing that the shutter is positively operated in both directions, and effective protection is afforded to the interior of the coin carrier in a very simple manner.

Revolving Grate for Gas Producers, &c. No. 188,256.

GOEHTZ, H., of Berlin-Schöneberg.

No. 35,076; Dec. 30, 1921.

This invention relates to a revolving grate of conical, turret, or bee-hive shape for use in generators, gas producers, shaft-furnaces, and the like, comprising a body which in a horizontal plane extends over practically the whole of the cross-sectional area of the shaft, and deeply incised recesses or passages therein for the reception and removal of the ashes.

In one construction shown, the upper portion of the grate has the shape of a stepped turret or cone; and numerous openings are provided in the single steps for the passage of the pressure air. The grate laterally extends through the whole of the cross-sectional area of the shaft, so that there is practically no free annular space between the periphery of the grate and the wall of the base-ring for the ash to drop through.

Deeply incised radial recesses or passages are provided extending from the centre of the grate downwards towards the periphery thereof. It is, however, not necessary that the passages should extend in radial direction; they may be given any other course between the centre and the periphery of the grate body.

In a modification there are similar radial passages for the reception of the ash, which passages extend from the top of a bee-hive shaped grate downwards to its base, and act to convey the ash in separate courses into the basin. The plan of this grate is star-shaped.

Meter Gas-Ways.—No. 189,865.

STANIFORTH, H., of Harrow-on-the-Hill.

No. 23,734; Sept. 6, 1921.

This invention relates to the passages connecting the valve ports of gas-meters to the measuring chambers. The object is compact design and easy assembling.

The patentee claims as his invention one or more gas passages adapted to connect the valve port with the measuring chamber, each comprising two tubes or castings characterized in that the upper tube is secured directly under the valve port, leads downwards in an approximately vertical direction from this point of attachment under the valve port, and at its lower end is provided with a coupling flange lying in an approximately vertical plane; the lower tube entering the measuring chamber in an approximately vertical direction, and being at its upper end provided with a coupling flange, adapted to be bolted or screwed to the approximately vertical coupling flange on the upper tube.

The tubes may be conveniently cast in white metal. In practice it will be found, says the patentee, that gas connections made in accordance with this invention are easy to manufacture, take up very little space in the meter, and are shaped and arranged so that the tubes may be easily connected and disconnected.

Thermometric Apparatus.—No. 189,665.

SIMMANCE, J. F., of Westminster Palace Gardens, S.W. 1.

No. 33,790; Dec. 15, 1921.

This invention relates to thermometric apparatus of the kind in which the actuating element responsive to temperature variations consists of two or more component metals or other materials having different coefficients of expansion.

The apparatus described comprises two expansion elements so connected together that the effect of the surrounding temperature upon one element is exactly neutralized by the effect upon the other; one of the elements being exposed to the temperature to be measured, and the other to suitable indicating or recording mechanism. A movement of one element due to a variation in their common temperature produces the displacement of the other element as a whole; this displacement being neutralized by the individual displacement of the other element as transmitted to the indicating or recording mechanism.

The invention is described and illustrated as applicable for the measurement of temperature variations in liquid contained in a vessel; and the system of elements and connecting rods is seen to be ingeniously simple.

Wet Gas-Meters.—No. 190,056.

COWAN, Sir H., and PARKINSON AND W. & B. COWAN, LTD., both of Kennington Road, S.E.

No. 3983; Feb. 10, 1922.

This invention relates to the duplex type of wet gas-meter, such as is described in patent No. 11,614 of 1902. In meters of this character the inlet control float is arranged in a side gallery, the water level in which follows the water level in the meter and is controlled by the usual overflow.

It has been found, says the patentees, that should the reserve water become exhausted and the water level in the measuring chamber fall by evaporation, it is possible for the meter to register slow. One object of the present invention is to overcome this difficulty; and another is to maintain the meter water level up to the point when the valve closes, due to the exhausting of the water supply in the waste-water box.

These objects are obtained by disposing the inlet control valve float within the reserve water chamber, and providing the water casing with a receptacle adapted to accommodate the sealing bend of the over-flow pipe and the guide of the float stem, which latter works in a tubular member passing through and secured to the gallery base, and constituting a stop for the float.

The advantages claimed for this construction are that:

(1) Sudden increase of inlet pressure does not affect the float.

(2) The float is so arranged that the valve is lifted high off its seating until the water is almost exhausted, which gives the meter a greater capacity.

(3) The meter cannot register slow (a most important feature from the gas supplier's point of view) as the water is always kept at high-water line with the spoon feed until the valve actually closes.

(4) The risk of the meter passing unregistered gas by partial filling is obviated, as the valve cannot open until the reserve chamber has received sufficient water to raise the float.

Gas Cooking Ovens.—No. 190,090.

RADIATION LIMITED, of Birmingham, and Others.

No. 17,259; June 22, 1922.

In introducing the description of this invention, the patentees remark that the present standard form of gas cooking oven comprises a heating chamber which is fitted at its lower end with one or more gas burners, and at its upper end with an outlet communicating with a flue or chimney. This form in its latest developments represents the results of many years of investigation and experience, and is the one employed by all the leading manufacturers of gas cooking ovens in this country. The performance of such ovens is generally agreed to be highly satisfactory; but they continue to be the subject of much study and experiment with a view to further improvement. A feature which has received close attention by the patentees is the continuous stream of combustion products and air which passes through the oven from the burners to the outlet. This streaming, though apparently unavoidable, is a cause of some loss of efficiency owing to inequalities of temperature which result in different parts of the oven, and the loss of heat due to the relatively rapid flow of gases through the oven.

The present invention has for its object to improve the thermal efficiency of such ovens, by means of a bottom outlet, at the same time enabling modern hygienic requirements to be satisfied. As a result of an exhaustive investigation of the thermal conditions and gas flow within a gas cooking oven, it has been found possible to avoid the cause of failure in the earlier proposals, and to construct an oven which complies with modern requirements and gives a higher thermal efficiency than the standard oven with top outlet. The invention comprises the employment, at or near the bottom of the oven, of an outlet which communicates at or near its own level directly with a flue, and the provision adjacent to the outlet, or in the flue at or near the outlet level, of an air admission aperture which, while not interfering with the proper discharges of gases from the oven into the flue, prevents the transmission from the flue to the oven of any detrimental suction effect.

In service, the hot gases delivered into the flue pipe maintain the required flow through the pipe, and the oven gases are carried away by the flue pipe without risk of leakage into the room containing the oven. But owing to the provision of the air admission aperture, the flue suction is mainly expended in drawing air into the flue from the room; and very little of the suction effect is felt in the oven. Consequently a relatively quiescent state exists in the oven chamber, and the products of combustion and the air admitted at the lower part of the oven produce a slowly, though constantly, moving gaseous mass which circulates through the oven before passing to the outlet. As a result, a higher mean temperature from the combustion of a given quantity of gas is obtained, and there is a more uniform distribution of the heat in the oven, than is otherwise practicable.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Dec. 30.]

Nos. 35,102 to 35,512.

ADAMS, M. J.—"Pipe joint." No. 35,241.
BEST, G.—"Dry scrubber for gases." No. 35,366.
DEWEY, W.—"Tar and impurity extractor for gas-engine plant, &c." No. 35,361.
ESSON, D. D.—"Tap-locking device." No. 35,401.
GESLAIN, O. L.—"Gas, &c., stoves." No. 35,218.
GRAAF, J.—See Esson, D. D. No. 35,401.
JEFFCOCK, E.—"Delivery-correcting device for retort-charging machines, &c." No. 35,138.
MACMILLAN, D.—"Gas-burners." No. 35,251.
NICHOLS, F. G.—"Gas-fire radiants." No. 35,175.
WEST, G.—See Macmillan, D. No. 35,251.
WILLIAMS, M.—See Best, G. No. 35,366.

Cheaper Gas at Bournemouth.—The Bournemouth Corporation Finance Committee have received a letter from Mr. P. G. G. Moon, the General Manager of the Gas and Water Company, informing them that, owing to the continued improvement in the prices at which the Company are able to purchase coals, and the general lower costs of working, the Directors are able to reduce the price of gas from 10·4d. per therm to 9d. per therm. Expressed in cubic feet, this represents a reduction from 3s. 10·8d. per 1000 c.ft. to 3s. 4½d. This reduction will take effect from the Christmas meter readings, and will represent a saving of £39,000 per annum to the consumers of gas in the Company's area of supply. Since Jan. 1 last year, the Company have been able to reduce the price of gas by 3·66d. per therm, or 1s. 4½d. per 1000 c.ft., which represents a saving to the consumers of over £100,000 per annum. The Town Clerk was instructed to write to the Company expressing the Council's satisfaction at the intimation.

MISCELLANEOUS NEWS.

THE THERM INQUIRY RESUMED.

Another Protest.

When Sir G. Clarendon Hyde's Committee, who are considering the problem of the therm system of charging for gas, resumed their sittings yesterday, there was again, at the outset, a protest on behalf of private consumers, made by Mr. Higgins, of Stanley Place, London, S.W. 1. When asked if he were a gas consumer, Mr. Higgins said he was previously a gas consumer, but was not now. The Chairman said that as the speaker was neither a representative of the public nor a gas consumer, he could not be heard. He then announced that circulars had been sent to over 102 local authorities and other bodies, and about 50 answers had been received; but, inasmuch as the new year had intervened, the others had probably not had time to reply. He mentioned four local authorities who had replied to the effect that they did not desire to give evidence, although complaining of the new method of charging for gas. Replies had also been received from various chambers of commerce, who also did not propose to give evidence.

Evidence was then heard from two representatives of the Railway Companies' Association—namely, Mr. J. Triffitt (Assistant Engineer of the North-Eastern Area of the London and North-Eastern Railway Company, and a member of the Railway Companies' Gas Committee), and Mr. W. Goodchild (Gas and Hydraulic Assistant to the Mechanical Engineer, Midland Division, London Midland and Scottish Railway). These witnesses agreed that the principle of the thermal system of charging was satisfactory, and should be retained; but the consumers must be adequately safeguarded. Mr. Triffitt said that the safeguards were fully dealt with in the Fuel Research Board's report to the Board of Trade; but they were not fully included in the Gas Regulation Act. These safeguards which were not adopted in the form suggested in the Fuel Research Board's report related to measurement of pressure, the provision of a recording calorimeter, and the adjustment of fittings. In the course of Mr. Goodchild's evidence, reference was made to the Nuneaton gas supply, which is at present of a very low calorific value. The price at Nuneaton was 3s. per 1000 c.ft., *plus* 40 p.ct., and it really worked out at about 17·7d. per therm; whereas in a neighbouring town, where gas was supplied at a reasonable calorific value, the price varied from 8½d. to 11d. per therm. This illustrated what the public were liable to suffer unless the Gas Regulation Act were enforced throughout the country.

The National Gas Council then took the field, and evidence was given on the scientific side by Prof. Cobb (of Leeds University) and Dr. Harold Hartley (Chief Chemist to Radiation, Ltd.), the latter demonstrating how the Radiation standard gas-fire burner could be adjusted to burn gases of varying quality efficiently, and pointing out that apparatus turned out by Messrs. Radiation, Ltd., allowed for adjustments for calorific values varying from 350 to 600 B.Th.U. to be made.

After the luncheon interval,

Mr. D. Milne Watson (the President of the National Gas Council, and Governor of the Gas Light and Coke Company) gave evidence, and occupied the greater part of the afternoon explaining to the Committee the advantages which accrued both to gas consumers and undertakers as the result of the introduction of the therm system of charging, the decreases in price since its introduction, dividends, and many other things. With regard to the Press campaign, he agreed with Mr. Woolcock that there always had been complaints from consumers; and the total effect of the enormous Press propaganda was that there were about two or three times as many complaints in one year as compared with the previous year. He believed the Press agitation arose from a misunderstanding, and explained that the gas industry welcomed the inquiry as a means of allaying any suspicion on the part of consumers.

Evidence was then given in support of the thermal system by Mr. Stanley Jones (Engineer and General Manager to the Commercial Gas Company) and Mr. J. D. Smith (the General Manager of the Belfast gas undertaking, and President of the Institution of Gas Engineers).

The only other witness was Alderman Phillips (the Chairman of the Gas Committee of the Salford Corporation), whose evidence was to the effect that gas was supplied at Salford on a calorific standard, and charged for on the volume basis. There were no complaints; and the Corporation did not intend to apply for an Order under the Gas Regulation Act and charge on the therm basis. At the same time, he said that no doubt the thermal basis of charging was perfectly fair and accurate.

The evidence will be reported more fully in our next issue.

GAS REGULATION ACT APPLICATIONS.

The following further notices have appeared in the "London Gazette" with regard to applications to the Board of Trade under the Gas Regulation Act.

Formby Gas Company, Ltd.

The maximum price now authorized in respect of the supply of gas by the undertakers is 6s. per 1000 c.ft.; and the price they have asked the Board of Trade to substitute for this is 1s. 4d. per therm.

Lowestoft Water and Gas Company.

The maximum price now authorized in respect of the supply of gas by the undertakers is 6s. per 1000 c.ft.; and the price they have asked the Board of Trade to substitute for this is 22·4d. per therm.

BETHNAL GREEN GAS FATALITY.

Inquest on the Three Victims.

An inquest was held by Dr. Edwin Smith (the Coroner), last Wednesday, on the three bodies of George Holloway, Ada Holloway (his wife), and Edwin Holloway (their son), who were suffocated in their sleep at Gale's Gardens, Bethnal Green, by gas which had escaped from a main belonging to the Gas Light and Coke Company, in circumstances recorded in last week's "JOURNAL," [p. 41].

In opening the proceedings, the Coroner remarked that a striking feature of the case was that, though these people were found dead in their beds, there was no gas laid on to the particular house which they occupied. Another striking point was that they were killed in their sleep, and had no chance to help themselves or each other. It was a decidedly disconcerting fact that one could die in one's sleep from gas poisoning without waking. He had had a number of cases in which the same feature had been present. This showed the very poisonous and insidious way in which coal gas could cause its victims to pass from sleep to death without waking. The question occurred as to whether it was possible to lessen the poisonous ingredients in gas or to introduce an irritant which would give rise to a cough, to wake the sufferer, who might be asleep during the escape of gas.

Being invited by the Coroner to address the Court, Mr. Percy Harris (M.P. for South-West Bethnal Green) said he would not have intervened but for the fact that the affair happened in a very poor street in a very poor borough—probably one of the poorest streets in London. The fact that the victims, who were the subject of the inquest, were not users of gas, made the matter all the more serious. The Gas Light and Coke Company had a fine reputation in London for their management, efficiency, and courtesy to consumers; but they had big interests, which were represented legally and technically. There were three questions to consider. The first was whether the mains that apparently were the cause of the accident were very old. It was an important point for the people of London whether, after a period of years, it was necessary to overhaul gas mains and replace them from time to time. The second point was whether there was proper periodical inspection; and the third, whether gas in its new form was more dangerous than in the old.

Medical evidence was given that the victims had died of coal-gas poisoning, and an employee of the Company, who proceeded to the scene in response to a telephonic message from the police, spoke to entering the house and carrying the three people from their beds.

Next Mr. A. R. Lodge, Assistant Surveyor to the Bethnal Green Corporation, said that the gas-pipe had been resting on some brickwork, and the escape was probably due to this fact, coupled with the sinking of the subsoil. The brickwork perhaps formed part of the old foundation of Gale's Gardens. A gas-main should not be placed on brickwork; it should be laid uniformly on soil.

Mr. Stephen Lacey, Distributing Engineer to the Gas Light and Coke Company, said he had no doubt that the fracture of the pipe was caused by the settlement of the subsoil and the holding of the pipe at the point of fracture by the brickwork. It was a good specimen of cast-iron pipe; and there were no signs of deterioration. There was no foundation for the suggestion that the gas as now supplied had not the same distinctive smell as formerly. In 22 years there had been nine cases, resulting in nineteen deaths, in the Company's area through gas escaping from mains.

Mr. W. J. A. Butterfield, one of the Gas Referees, said there was no ground for the statement that there had been a large difference in the character of the gas supplied. This point was being carefully watched by the Board of Trade. It was practically impossible to suggest the addition of any irritant gas which would rouse people from their sleep. The danger was greatly reduced by the strong smell of gas, so that people awake could know of an escape. It was illegal to supply gas without that strong smell. The danger of leakages from roadways was best met by collaboration between gas companies and local authorities to ensure that whenever a road was opened for any purpose an opportunity would be given for the main to be inspected.

The Jury returned a verdict that "Death was due to coal-gas poisoning caused by the gas escaping from a fractured main-pipe in the roadway, and that the pipe was not laid with sufficient care." Later it was represented to the Coroner that the verdict, in the terms given, was hardly fair to the Company. Mr. Lacey pointed out that what would be negligence now was not negligence in 1880, when the main was laid. Mr. Lodge assented to this. As a result, the Jury finally recorded their verdict in the following terms:

> That the deceased persons died from coal-gas poisoning caused by gas escape from a fractured main-pipe in the roadway, and that the pipe, though laid in 1880 in a manner involving no neglect at that date, fractured on account of its having been laid across some brickwork which caused unequal support and consequent strain as a result of a subsidence of the subsoil.

Stoke-on-Trent Centralization Scheme.—In connection with the scheme prepared by Mr. A. Mackay, Chief Engineer and General Manager of the gas undertaking, for the centralization of gas manufacture at the Etruria works, the Stoke-on-Trent Town Council have agreed to a recommendation that Mr. W. Doig Gibb, of London (the expert nominated by the President of the Institution of Gas Engineers), should prepare for them a comprehensive report on all aspects of the undertaking.

Bristol Gas Price Reduction.—The Directors of the Bristol Gas Company have decided to make another reduction in the price of gas, to take effect in the quarter ending March. The reduction will be from the present 8½d. per therm to 8d. In other words, while for the December quarter the charge has been 3s. 4·8d. per 1000 c.ft., it will be 3s. 2·4d. for the current quarter. This is the fifth reduction in rapid succession. In the quarter ended December, 1921, the price was 4s. 6d. per 1000 c.ft.

AN ENGLISH COMPANY ABROAD IN PEACE AND WAR.

Continuing, in the December issue of the Bournemouth Gas and Water Company's "Co-Partner" magazine, his serial account of the work of the Imperial Continental Gas Association under peace and war conditions [see "JOURNAL" for Aug. 23 and Nov. 8], Sir Charles Jessel, Bart., deals with the history of the German establishments in the war.

At one time the Imperial Continental Gas Association supplied with gas the following towns in Germany: Aachen (Aix-la-Chapelle), Berlin (a portion of the city and the majority of the suburbs to the north and west), Cologne (with the industrial district of Ehrenfeld), Frankfort-on-Main, Hanover, Linden, and Stolberg. The works and mains at Cologne were purchased by the Municipality on the termination of the contract in the year 1873. Ehrenfeld was disposed of to the Municipality of Cologne, into which it had become incorporated in 1890. Stolberg, which was a very small works in the vicinity of Aix-la-Chapelle, was sold in 1892. In 1909 the Frankfort business was amalgamated with the Frankfort Gas Company (who were restricted to the use of cannel coal), and a new Company formed (without restriction as to the description of coal used), in which the Frankfort Municipality took a financial interest; and a new contract until 1959 was concluded. The Association's direct interest in the management ceased; but indirectly they took considerable part, as four members of the Imperial Continental Board (of which Sir Charles Jessel was one) were elected to the Board of the new Company. After the most strenuous efforts to renew the contract expiring in 1913 with Aix-la-Chapelle, the undertaking was sold to the Municipality, and the money was paid over just previous to the outbreak of war. Thus when war occurred between Great Britain and Germany, the Association owned only two stations—Berlin and Hanover-Linden.

At Berlin (where in 1913 five works produced 5,868,580,000 c.ft.) they carbonized 472,124 tons of coal, 60 p.ct. of which was English, and had 974 miles of mains, on which were 226,000 consumers with 258,000 meters. This establishment contributed £473,964 towards the total profit of the Association—considerably more than one-half. At Hanover there were two works, one of which, erected in Linden on the most up-to-date lines, was only completed in 1914. Here over 130,000 tons of coal were annually carbonized; there were 326 miles of mains; and 91,500 consumers with 106,000 meters. The profit yielded was over £50,000 per annum. In Berlin the Association had perpetual right to supply; while in Hanover they had in 1911 renewed the contracts until 1950, paying a lump sum of half-a-million sterling for the privilege.

When hostilities commenced, the first duty performed was to inform the Government in detail of the position of the Association, the proprietors of which numbered over 7000, of whom only 3 p.ct. had a foreign domicile; and among this small percentage were officers of the Association who had invested their savings in the undertaking. Of the seven members of the London staff who responded to the call of duty, no less than five fell in front of the enemy, and two were seriously wounded. Two members of the Board also served their country. Colonel Le Roy-Lewis, C.B., C.M.G., D.S.O., was a Military Attaché in Paris during the greater part of the war, and Mr. Harold G. Palmer held a Commission in the Engineers. He also was seriously wounded.

Another duty which required much attention and involved much anxiety was the supply of coal to our French Allies, and the financing of the many cargoes. From the end of 1914 to June, 1917, when the French authorities took the matter into their own hands, coal to the value of over £272,000 was bought and dispatched through the agency of the Board.

The Board learned that, by a Decree of the Bundesrat (Federal Council), a Controller had taken charge of the business of the Association in Berlin, with the Manager of the Corporation Gas-Works as Technical Adviser, and that the authorities of Hanover had signed an agreement stipulating that they, for the term of the war, would take-over the entire control of the Hanover establishments for the account of the Association.

Mr. R. W. Wilson (then Secretary) left for Amsterdam on Nov. 6, 1914, and reported that the position of the Association in Berlin at the outbreak of war was an exceedingly critical one. An attack, especially in the first days, upon the works was dreaded, and protection was asked for. In return for this, the authorities decided that the business should be treated as a purely German undertaking, and be called upon not only to subscribe to the Red Cross and kindred institutions, but also to take-up a large amount of the first war-loan. The Corporation did all in their power to get the Association's concession cancelled, and so put them in such a position that they would have to hand-over their works to them. They failed, as the Government declined to listen to them. In fact, from first to last, the German Government behaved very decently towards the Association.

In the early days of the occupation of Belgium, the German Government were very solicitous that the Association's establishments in Antwerp and Brussels should be maintained in an efficient condition. They assisted in every way in making arrangements for the supply of coal and for the repair of the apparatus and gasholder at Berchem, which had been damaged by the bombardment.

Prestatyn Gas-Works Improvements.—A special meeting of the Prestatyn Urban District Council has been held to consider a recommendation of the Gas Committee regarding certain improvements and extensions at the works. Mr. A. Caradoc Williams (the Chairman of the Gas Committee) pointed out that the present storage capacity was inadequate. Regarding the proposed new railway siding, it would certainly be far more economical than the present inconvenient method of carting the coal. A new retort-house was essential. These extensions would entail an expenditure of £14,000. A resolution was adopted that application be made to the Ministry of Health for sanction to raise a loan.

THE GAS INDUSTRY IN THE UNITED STATES.

Statistics for 1921.

From general statistics compiled partly from returns made to the American Gas Association by a large proportion of the companies, and partly from information derived from other sources, it appears that the number of undertakings in the United States engaged in supplying manufactured gas to the public is 964, which includes 48 municipal plants. The number of coke-oven plants selling gas to distributing companies is 84. An analysis of the manufacturing systems shows that there are 208 coal-gas plants, 415 water-gas plants, and 76 oil-gas plants; while 87 undertakings purchase their gas and distribute it, and five partly meet their requirements by purchase.

Number of cities, towns, and villages served (estimated)		4,600
Number of meters—prepayment	1,244,900	
ordinary	8,046,100	
Total		9,291,000
Number of consumers		9,200,000
Miles of gas-main		69,500
Meters per mile of main		134
Number of active services		6,383,000
Population served		46,700,000

Estimated Production of Manufactured Gas—1921.

	Thousand C.Ft.
Carburetted water gas	206,352,000
Coal gas	62,486,400
Oil gas	26,323,700
Coke-oven gas purchased and distributed for public use	37,392,500
(Coke-oven gas consumed at point of production or for purposes other than public use is not included.)	
Total manufactured gas	332,554,600
Natural gas purchased and mixed with manufactured gas for public use	27,837,000
Grand total	360,391,600

Estimated Volume of Manufactured Gas Sold—1921.

Purpose.	P.Ct.	Thousand C.Ft.
Illumination	18·50	60,442,000
Domestic uses other than illumination	56·71	185,459,700
Industrial	21·62	70,671,200
Other uses not classified	3·17	10,378,000
Total		326,950,900
Total gross revenue—sale of gas		$379,263,044.00
Annual consumption per meter		35,190 c.ft.

**Coal and Oil Used in Manufacture of Gas for Public Use.*

Bituminous coal	7,113,900 short tons
Anthracite coal	1,832,700 " "
Coke	2,412,700 " "
Gas oil	897,968,000 gallons

* Note.—These figures do not contain the materials used for the manufacture of the coke-oven gas purchased by distributing companies for public use.

Domestic cooking appliances in use 1921	7,040,000
Water heaters in use—all types	1,573,000
Space heaters in use	1,268,000
Incandescent burners for illumination, not including "arc" lamps or street burners	8,800,000
Number of persons employed by gas companies as officers, executives, and salary and wage earners	73,000

Estimated per Capita Consumption of Manufactured Gas for the last Twenty Years.

Year.	Consumption per Capita. C.Ft.	Year.	Consumption per Capita. C.Ft.
1901	1310	1911	1704
1902	1221	1912	1882
1903	1310	1913	1960
1904	1383	1914	2040
1905	1340	1915	2067
1906	1435	1916	2308
1907	1514	1917	2604
1908	1561	1918	2638
1909	1583	1919	2939
1910	1623	1920	3026
1921	3053 c.ft.		

		P.Ct.
Percentage of increase in per capita consumption	1901—1921	133
" " " " "	1901—1911	30
" " " " "	1911—1921	80
Average yearly percentage of increase in per capita consumption	1901—1911	2·8
Average yearly percentage of increase in per capita consumption	1911—1921	6·0

Long Eaton Capital Issue Success.—A successful issue of new capital has just been made by the Long Eaton Gas Company. There was offered at par £30,000 class "A" ordinary stock, which will rank *pari passu* with the existing "A" stock of the Company, upon which they are entitled to pay dividends at the standard rate of 5 p.ct. per annum. For the last six years the Company have declared dividends of 7 p.ct. (less tax) upon the existing "A" stock. The Company have a reserve fund invested in Government securities, to-day's value of which is nearly £10,000. This amount is available for equalization of dividends if necessary. The new issue was over-subscribed within a few hours. The money is to provide for the steadily increasing demand for gas in the Company's existing district, and also to complete the purchase of the undertaking of the Draycott Gas Company. The amalgamation of the two Companies is authorized by a Special Order of the Board of Trade.

BRITISH COMMERCIAL GAS SALESMEN'S CIRCLE.

Midland District.

At the last meeting of the Midland Association of Gas Engineers and Managers, it was decided to convene, at the instance of the British Commercial Gas Association, a meeting of the gas undertakings in the Midland Area, to discuss the formation of a Salesmen s Circle for the district. This preliminary meeting was held on Wednesday, Nov. 29, when representatives from many of the local gas undertakings attended. The proceedings were reported in the December issue of the "Gas Salesman."

At that meeting it was decided to form a Salesmen's Circle, officers were appointed—with Mr. R. J. Rogers as President, and Mr. F. R. Ayre, Council House, Birmingham, as Hon. Secretary—and the following gas undertakings were invited to nominate a representative to serve on the General Committee: Birmingham, Burton, Cheltenham, Derby, Coventry, Gloucester, Leicester, Nottingham, Redditch, Smethwick, Stafford, Stoke, Stourport, and Wolverhampton.

It has been arranged to hold meetings of the Circle on the second Wednesday in each month, at 2.30; and among the subjects which are to be discussed at the first few meetings are:

Gas-Fire Problems.
Shops and Showrooms.
Hot-Water Business.
Competition with other sources of Light, Heat, and Power.
Gas-Fires in Hotels and Boarding Houses.
Publicity.
Hiring Systems.

The first meeting will be held to-day (Wednesday) at the Chamber of Commerce, New Street, Birmingham, when the business will comprise the approval of the rules, an address by the President, and a discussion on "Hiring Systems," to be opened by Mr. A. Hammond, of Coventry.

By permission of the General Manager and Secretary (Mr. A. W. Smith), the showrooms and stores of the Birmingham Gas Department will be open for inspection after the meeting.

Belfast Gas Undertaking.—In a review of the position of the Belfast Gas undertaking in 1922, it is stated that, after payment of dividends on capital £29 406, there was a net profit of £26,103; that the debit balance is wiped out; and that there is close on £20,000 to credit of profit and loss. At the close of the financial year there was a gross profit on manufacture and sale of gas and residuals of £66,001, being an increase of £28,403 as compared with 1921. There is a total profit of £66,636. The price of gas is now 3s. 9d. per 1000 c.ft.

TRADE NOTES.

Kent's Positive Meters.

An order has recently been received by Messrs. George Kent, Ltd., of High Holborn and Luton, from the Metropolitan Water Board, for 100 Kent's Mark III. Positive Meters.

Horseley Company's Contracts.

During the past month, the Horseley Bridge and Engineering Company, Ltd., of Dudley Port, Tipton, received contracts for a three-lift gasholder and tank for the Eastbourne Gas Company, a two-lift gasholder and tank for the Tendring Hundred Gas Company, and a set of five tar stills for the Leicester Corporation.

Fuel Economizing Appliances.

The closing month of 1922 brought Messrs. Meldrums, Ltd., of Timperly, near Manchester, a good batch of orders for their forced draught furnaces and mechanical stokers. Two of the orders were from gas departments—and also one for seven oil burners, for burning residual oil from low-temperature carbonization. Their refuse destructors were also in considerable demand.

Horstmann Controllers.

The Institute of Municipal and County Engineers carried out trials of apparatus for municipal work at Cardiff last year; and out of some 130 exhibits, the Horstmann Gear Company, Ltd., of Newbridge Works, Bath, had their display of gas controllers highly commended. The comments of the judges were to the effect that these controllers were very satisfactory. The Horstmann Company will be exhibiting at the British Industries Fair, Birmingham, from Feb. 19 to March 3—Stand D 28.

Calendars, &c.

In addition to the calendars mentioned last week, a substantial and very useful desk pad, with calendar at side, and a diary (included in which is some useful information) has been received from Messrs. Mobberley and Perry, Ltd., of Stourbridge. Messrs. W. Parkinson & Co., of London and Birmingham, have also forwarded a large-size desk blotting pad, fitted at the top with an adjustable calendar. A wall calendar is also to hand from Messrs. W. H. Wilcox & Co., Ltd., of 38, Southwark Street, S.E., which is a good advertisement of their engineers' stores.

Early Gas Supply of New York.—The first Gas Company established in New York State, and the third in the United States, was, says the "Gas Journal of Canada," the New York Gas Light Company. It was incorporated in 1823. Its predecessors were a Company established in Baltimore in 1816, and one founded in Boston in 1822. During the first four years of the New York Company's existence, the charge for gas was $10 per 1000 c.ft.—and customers increased in number, and did not complain about the rate.

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NORTH-EAST COAST COAL TRADE.

From Our Own Correspondent.

At the beginning of the New Year, it may not be out of place to discuss briefly the coal-trade prospects for 1923, as viewed on the Newcastle market.

Generally speaking, the year begins, as the last one ended, with holders distinctly "calling the tune," and buyers hunting colliery fitters on 'change, instead of the latter hunting for business, as they have so often had to do during the past two years.

In the course of the last few months, the outlook for the trade has undergone a decided improvement. The demand for all descriptions for export has been such as to give rise to a general raising of quotations. Collieries generally have had no difficulty in working full time, and the increasing quantities due to better work and greater production per man have easily been sold at steadily rising prices. Renewed inquiry from America has not been without its effect on sentiment and quotations, although little actual business has probably been put through; increasing prices and freights making it difficult for the Americans to come to terms. They are, however, undoubtedly still feeling the effect of the recent strike; and normal stocks are not yet replaced, while there is always the prospect of fresh trouble there when the temporary agreement ends in March. The knowledge of this is no doubt a bull point for the English coal trade, and, though producers are inclined to quote stiff rates for America while other trade is available, they could probably place business there should other prices tend to fall away.

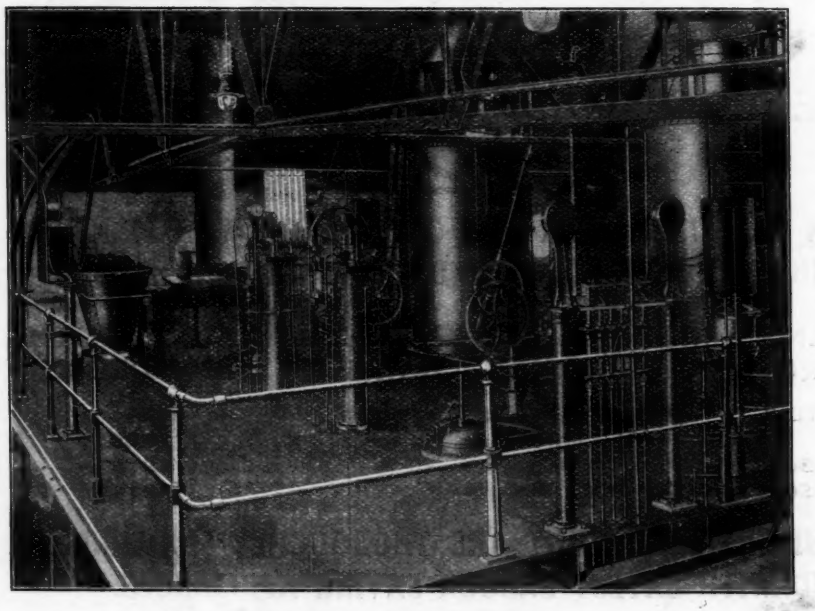
The result of the better feeling at the end of 1922 is that high-class gas coal collieries at any rate, who mostly held off until quite late, have been able to sell for 1923 large quantities of unscreened up to 24s. f.o.b. for Wear Specials and 23s. 6d. for best qualities (Holmside, New Pelton, Boldon class), so that they regard 23s. to 24s. as their basis price for the current year. Wear Specials have been sold for export to America over the first three months at 25s., and the present demand is such that this price is being asked for such odd parcels of best qualities as may be free for early delivery. Even at this figure there is little coal obtainable, except when bad weather or congestion at the loading places or any other reason leaves a colliery temporarily "short of team." A good deal of second-class gas has been sold over the year at 21s. to 21s. 6d. f.o.b., though 21s. 6d. to 22s. can now be obtained for forward contracts, and as much as 23s. is asked for odd lots for prompt delivery. This, however, depends to a great extent upon the particular position of any particular colliery with regard to tonnage and loading turns.

The position, therefore, for 1923 may be summed-up as full of optimism for the collieries; and they are still inclined, where they have not fully sold for the year, to "run the market" rather than cut quotations. Much must, of course, depend upon Germany. People have been saying ever since the mark began to tumble, that the time must come when she can no longer buy in our markets. But, with the mark well over 30,000, she has been buying far more than she was a year ago before the hopeless tumble began; and those who deal in that market have not yet given way to pessimism. Against the possibility of German trade falling away, there is still the expected gradual industrial revival at home, which has not as yet gone far enough to affect appreciably the coal market. An interesting point is also that there are already inquiries circulating, which look like maturing into business, for large shipments to Canada during the open season (April-October); competition with U.S.A. coal appearing to have great possibilities in this field.

On the present position, therefore, of their extensive forward sales, and the indications of to-day's market, collieries are looking forward with every confidence to a satisfactory year, with quantities on the increase, and every hope that industries at home may want more coal, and the knowledge that shipping cannot at any rate need less bunkers, than in the last two years. If it is any consolation to consumers, they may be reminded of the fact that prices are not likely to run away to any extravagant heights. It was demonstrated only too clearly after the disastrous stoppage of 1921 that there comes a price (which is certainly somewhere below 30s.) at which the Americans can come into competition with us in nearly all our markets.

With regard to labour questions, collieries in this district are not inclined to take a pessimistic view. It is generally agreed that the men, at any rate in these parts, have had about all they want for the present. From the way in which they are working and increasing the output (nearly up to pre-war in some cases), it appears they are trying to make the best of what is, in some cases undoubtedly, a lean time for them. But the more coal per shift, the cheaper per ton. And with increasing quantities, and the higher prices now obtainable, there appears every prospect of there being a profit for owners and men to share under the agreement—at any rate, in Durham and Northumberland. In that case, it seems highly probable that they will be inclined to give the agreement another run.

The Baillieston Gas Undertaking.—It has been reported to the Glasgow Corporation Gas Committee that a Special Sub-Committee had considered the letter from the Law Agents of the Baillieston Gas Light Company, Ltd., asking if the Corporation would be willing to surrender their rights to supply gas in the area at present served by the Company. Having heard the Town Clerk and the General Manager on the subject, the Committee had agreed to recommend that the right granted to the Corporation under the Glasgow Gas Act, 1910, to supply gas in the Baillieston area, be retained; and that the Town Clerk, in conveying this decision, intimate to the Company that the Corporation are prepared to consider further the question of taking over the Company's undertaking if reasonable terms for its acquisition can be arranged.



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CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Jan.* 8.

The tar products market generally maintains a firm tone. Pitch continues in demand; the price being in the neighbourhood of 130s. per ton f.o.b. makers' works. Creosote is steady at not below 8½d. per gallon net and naked. Pure benzole and pure toluole are about 2s. 5d. per gallon; solvent naphtha 95/160 being about 2s. to 2s. 1d. per gallon. Pyridine continues in demand; the price being about 10s. 6d. per gallon. Crystal carbolic acid also continues in request; 8½d. to 8¾d. per lb. being obtainable.

Tar Products in the Provinces.

Jan 8.

The average values for gas-works products during last week were: Gas-works coal tar, 74s. to 79s. Pitch, East Coast, 125s. to 130s. f.o.b. West Coast—Manchester, 120s. to 125s.; Liverpool, 121s. to 126s.; Clyde, 125s. to 127s. 6d. Benzole 90 p.ct. North, 1s. 7½d. to 1s. 8d.; crude 65 p.ct. at 120° C., 1s. 0½d. to 1s. 1d. naked at makers' works; 50-90 p.ct., naked, North, 1s. 11d. to 2s. Toluole, naked, North, 1s. 11d. to 2s. nominal. Coal tar crude naphtha in bulk, North, 8½d. to 9d. Solvent naphtha, naked, North, 1s. 8d. to 1s. 10d. Heavy naphtha, North, 1s. 6d. to 1s. 8d. Creosote, in bulk, North, liquid, 7½d. to 7⅝d.; salty, 6⅝d. to 7d. Scotland, 6d to 6½d. Heavy oils, in bulk, North, 7d. to 7⅛d. Carbolic acid, 60 p.ct., 2s. 5d. to 2s. 7d. Naphthalene, £15 to £16; salts, £6 to £8, bags included. Anthracene, "A" quality, 4d. per minimum 40 p.ct., purely nominal; "B" unsaleable.

FROM A MARKET CORRESPONDENT.

Bye-Products Trade.

There is very little change to report in bye-products. Outputs are gradually increasing, but not so rapidly as to cause any surplus material on markets. Pitch remains as last quoted. The demand is good all round. Carbolic acid is a good feature, particularly crystals, which are now quoted at 8½d. to 9d. per lb.; while crude 60's are 2s. 2d. per gallon. Cresylic acid is 2s. 4d. to 2s. 6d. per gallon; naphthalene crudes being £5 to £7, and refined £18 per ton. Intermediate products are firm on a good inquiry, but without any material change in quotations. With increasing productions of bye-products generally, we are able to report on fairly free markets once again. It is therefore our intention, at the request of many correspondents, to revert to our practice of giving full quotations in tabular form. These will reappear next week.

Sulphate of Ammonia.

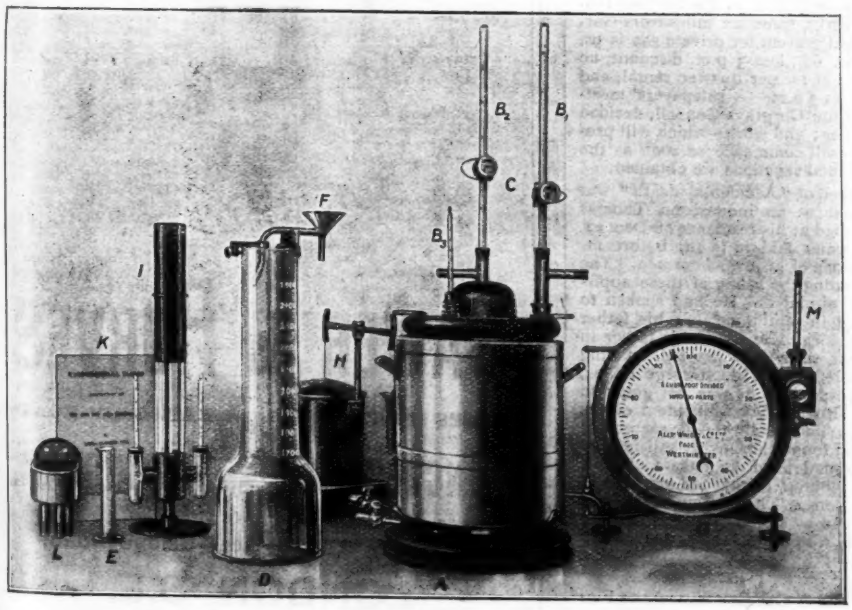
Prices of sulphate of ammonia have been increased as anticipated, and now £16 18s. per ton for 25⅝ p.ct. neutral quality and £15 15s. for 25¼ p.ct. ordinary quality are quoted.

The Fire at the Provan Gas-Works.—Reporting to the Glasgow Corporation Gas Committee the recent fire at the Provan Gas-Works [see "JOURNAL" for Dec. 27, p. 810], the General Manager (Mr. J. W. M'Lusky) said the damage was estimated at about £300, and that, as the result of the prompt action of the Station Manager and employees in isolating the affected part, the adjoining portions of the plant had been saved from injury. The Committee, after consideration, agreed to record their appreciation of the special services rendered by the Station Manager and employees in the emergency.

"Around the Clock with Gas."—This is the title of a new educational moving-picture film prepared for the American Gas Association, which is loaned out to those desirous of showing it merely on payment of freight charges. Seven prints are available for this purpose. The film depicts the gas business as a big, essential industry serving the nation 24 hours of each day. One sees, among other things, how gas is made, the raw material used, the gas-making machinery employed, the valuable bye-products saved, how gas is eliminating ashes and smoke, what happens when coal is burned in the raw state, how coke is made, gas at work in a score of vital industries, gas at work in modern appliances in the home, what the term B.Th.U. means, the tremendous growth of the gas industry in the United States, &c. The film is non-technical, and is designed to appeal directly to the public. Each scene is full of action, the photography is specially good, and the general effect is altogether pleasing.

Gas Exhibition at Morecambe.—On Monday evening last, an interesting exhibition was opened by Alderman J. R. Burkett, J.P. (the Mayor), at the Albert Hall, Victoria Street, Morecambe. The whole of the exhibition, which has been organized by the Morecambe Corporation Gas Department (the Engineer and Manager of which is Mr. Thomas W. Barrett) is devoted to the display of gas cooking, heating, and lighting appliances. The Gas Department offer consumers easy terms of hire-purchase for a large variety of apparatus. The gas cookers, fires, and water-heaters exhibited are by the Richmond Gas Stove and Meter Company, and include the well-known "Bungalow," "Bungalow Elevated Range," "New Model," and "Elswick" cookers; "Period" gas-fires, and alsotheir new "Standard" gas-fires fitted with Radiation "Thermo XX." fire front and patent injector-ventilator; and numerous other popular gas-heated apparatus. The exhibition remains open during this week; and in the afternoon and evening of each day, Saturday excepted, cookery lectures and demonstrations are being given by Miss H. H. Tuxford, M.C.A. Gold Medallist. The menus provided are such as will appeal to all classes of the residents.

BOYS CALORIMETER



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Reduction in Price at Wrexham.—The Directors of the Wrexham Gas Company announce, as from the December meter readings, a reduction in the price of gas of 1d. per therm (equivalent to 4½d. per 1000 c.ft.). Special discounts are allowed to large consumers.

Consett Gas to be Cheaper.—The Shotley Bridge and Consett District Gas Company announce that from the meter readings for the December quarter the price of gas to ordinary consumers will be reduced from 1s. 2·4d. to 1s. 1·2d. per therm, while slot consumers will have an increase from 12 to 13 c.ft. for 1d. These prices are a reduction equivalent to 6d. per 1000 c.ft.

Electric Light Failures at Acton.—The electric light, which failed over a large area of Acton last Saturday night owing to a motor-car colliding with a switchbox, failed again on Monday evening, when a still wider area was affected. The cause of the second failure was believed to be that the temporary repairs at the switchbox threw a great strain on other switchboxes, some of the fuses being blown out.

Coal Carbonization in Gas-Works.—A good paper, which led to an interesting discussion, upon the subject of "The Carbonization of Coal as Carried out on Gas-Works," was contributed by Mr. H. B. Holliday, B.Sc., of the Neepsend Works of the Sheffield Gas Company, at a meeting on the 29th ult. of the Sheffield and District Local Section of the Junior Institution of Engineers. The subject was covered from gas-works valuation of coal to the therm; and the author was aided in his various descriptions and explanations by an excellent series of lantern slides.

Leatherhead Gas Company's Progress.—A new issue of 1000 shares of £10 each by the Leatherhead Gas and Lighting Company has been rendered necessary by the rapid growth in the sale of gas, which has increased from 64 million c.ft. in 1914 to 110 millions last year. A contract has been entered into for modernizing the gas manufacturing plant by the installation of vertical retorts, and various other improvements. The Company's standard price under the Gas Regulation Act is 16·8d. per therm of 500 B.Th.U., on which basis the Company are entitled to pay a dividend of 5 p ct. The price has, however, already been reduced to 13 8d. per therm, which entitles the Company to pay a very substantial increase on the last dividend. The rate paid for the year to June 30 last was 6½ p.ct.

Mantle Makers' Carnival.—The large hall of the Wandsworth Baths presented quite a kaleidoscopic appearance on Monday evening last; the occasion being the New Year's Carnival dance of the "Iris" Social Club, the members of which are employees at the "Ironclad" Gas-Mantle Works of Messrs. Curtis's and Harvey, Ltd. Some 500 members and friends took part in the carnival. The interest taken by the management in their employees' social welfare was evidenced by the presence of Mr. C. S. Garland, M.P., the Managing-Director, and Mr. A. Metcalfe, the Manager and Secretary of Lighting Trades, Ltd., and Mr. Austin, Manager of the "Ironclad" Mantle Works. The prizes were presented by Mrs. C. S. Garland (wife of the Managing-Director), who was handed a bouquet by Miss Joan Washington.

Skipton and the Gas Supply of Gargrave.—Gargrave, a considerable agricultural village in West Yorkshire, has hitherto depended for its gas supply on the services of private gas-works run in connection with the local mill and the Eshton Hall Estate. For a considerable time past, however, the revenue from the village has not been a paying proposition to the producers, and the village has more than once been on the verge of deprivation of light. Inquiries as to the possibility of electricity have failed to reveal any encouraging prospect, and so the local Council have now done what one would have imagined they should have done a long time ago—appealed to the Skipton District Council for a supply from their works, some six miles from Gargrave. The price Gargrave is paying at present for private gas is 9s. per 1000 c.ft. The Skipton offer is 6s. 6d., less 3 p.ct. discount, no charge for meters, gas-cookers supplied at 1s. per quarter rental, and all other requirements at prime cost, *plus* 5 p.ct. A ratepayers' meeting, held recently at the instance of the Gargrave Council, decided unanimously to accept the Skipton offer; and work—which will provide something for the unemployed—will commence as soon as the Board of Trade and Rural District Council sanctions are obtained.

An Unventilated Geyser.—A verdict of "Accidental death" was recorded by the Birmingham Coroner at an inquest on Thomas Constable, a builder, of Nechells, who died at his residence on Dec. 22. A son stated that there was no hot water laid-on in the bathroom, and his father had a geyser put in by one of his own workmen. The makers, on a card of instructions respecting the fitting of these appliances, stated that all geysers must be ventilated. He had spoken to his father about the need for putting in ventilation, but his father replied that he would not go to the expense. He found his father in the bathroom, which was full of steam, with the water still running from the geyser. His father was apparently in a fit. George Eades, a plumber, stated that Mr. Constable told him he was not going to have a ventilating pipe. Mr. R. J. Rogers, Superintendent of the Birmingham Corporation Fittings Department, said the geyser was of a type in universal use, and had been found thoroughly satisfactory when fitted in accordance with the instructions of the makers. In this case the instructions had been totally ignored, so that the products of combustion were discharged into the room. The instructions clearly stated that all geysers must be ventilated by a pipe carried either into the chimney or out of the room. Death, said the doctor, was due to asphyxia caused by gas poisoning.

On a recommendation by the Bradford Gas Committee, the Finance Advisory and Co-Ordination Sub-Committee of the Corporation—who have supreme power (with the exception of the City Council themselves) in regard to municipal expenditure—have agreed to allocate £5000 for the purpose of replacing old or laying new gas-mains as required.

The Bradford Corporation Finance and General Purposes Committee have refused an application from the employees at the Corporation chemical works (under the control of the Gas Committee) to be placed under awards of the Industrial Gas Council, instead of coming, as at present, under the jurisdiction of the Industrial Council for the Chemical Industry.

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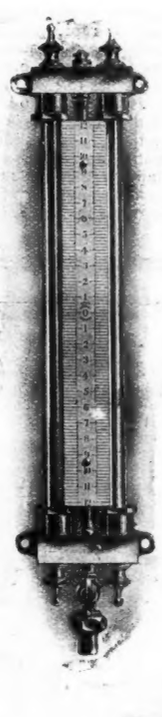

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STOCK MARKET REPORT.

THE Stock Exchange reopened in cheerful mood on Tuesday (after the New Year's Day closure), markets in general being firm. Home Government issues, Bonds, and Indians were strong. Home Rails made a fair *debut* under their new names.

Wednesday's position was similar. Thursday and Friday were weaker on the Paris breakfast—but rallied slightly by the close. Home Governments closed at an advance.

Business in the Gas Market was fairly active, but was mostly in Gas Lights and Primitivas; the preference shares of the latter being in brisk demand. The general tendency was firm; all changes (albeit few in number) being upward. British rose 1, Continental Union preference and Imperial Continental 2 each, Primitiva preference and San Paulo preference ¼ each. [It will be observed that our Table of prices and dividends has been enlarged to include some important recent issues.]

The following transactions in gas were recorded during the week; Monday being a closed day on the Stock Exchange. On Tuesday, Bombay 90s., British 34¼, 34⅜ Gas Light ordinary 93⅜, 94, 94¼, 94⅜, 94½, 94⅝ ditto 4 p.ct. preference 77½ 77⅝ 78 78½, Imperial Continental 159 Liverpool 7 p.ct. preference 106⅜, Oriental 98½ Primitiva 13s. 4½d., 13s. 6d., ditto 5 p.ct. preference 47s., 48s., 49s. 6d., San Paulo 6 p.ct. preference 5⅜, 5⅝, ditto 5 p.ct. debenture 37, South Metropolitan 93⅜, 94, 94½, 94⅜, ditto 3 p.ct. debenture 6-⅜, 6 ½, ditto 6½ p.ct. debenture 105⅜, Tottenham "B" 101½, Wandsworth Wimbledon 97, Croydon 4 p.ct. debenture 75. On Wednesday, Alliance and Dublin 64⅜, Bombay 92s. 6d., Brighton and Hove "A" 123, 123½, 124, British 34⅜, Cape Town 4½ p.ct. preference 6⅝, 7, Commercial 4 p.ct. 95, ditto 3½ p.ct. 96, ditto 3 p.ct. debenture 56, Continental Union 7 p.ct. preference 53, Croydon maximum dividend 82⅜, 83½, Gas Light ordinary 94, 94⅛, 94¼, 94⅛, 94⅜, ditto 3½ p.ct. maximum, 63, 63½, Hornsey 7 p.ct. 130½, 131, Imperial Continental 159½, 159⅝, Primitiva 5 p.ct. preference 48s., 48s. 6d., 48s. 9d., 49s., 49s. 3d., 49s. 6d., 49s. 9d., 50s., 50s. 6d., South Metropolitan 94, 94⅛, South Suburban 99½, 100, Croydon 4 p.ct. debenture 76. On Thursday, Brighton and Hove "A" 123½, Continental Union 7 p.ct. preference 57, Croydon sliding-scale 99, ditto maximum dividend 82⅜, 83½ Gas Light ordinary 94 94⅛, 94¼ 94⅛, ditto 3½ p.ct. maximum 62½, 63⅜, ditto 4 p.ct. preference 77½, 78, ditto 3 p.ct. debenture 60½, Imperial Continental 160, 160½, 161, ditto 3½ p.ct. debenture 80, Primitiva 5 p.ct. preference 50s. 6d., 50s. 7½d., 51s. 3d., 52s. 6d., 53s. 6d., San Paulo 6 p.ct. preference 5⅞ ditto 5 p.ct. debenture 36⅞, South Metropolitan 94 94⅛ 94⅛, 94¼, South Suburban 5 p.ct. debenture 95½, Croydon 7½ p.ct. preference 102½, 103, Hornsey 5 p.ct. 99, Uxbridge and Wycombe 5 p.ct. 85. On Friday, Brentford "A" 102, ditto 4 p.ct. debenture 76, Brighton and Hove "A" 124, British 35, Commercial 4 p.ct. 95½, Continental Union 7 p.ct. preference 55, Croydon sliding-scale 101, Gas Light ordinary 94. 94⅛. 94⅛. 94⅜, 94½. 94¾, ditto 3½ p.ct. maximum 62½, 63⅜, 63½, ditto 3 p.ct. debenture 60, 60½, Imperial Continental 159, 159½, 160, Liverpool 7 p.ct. preference 106⅜, 106½, Oriental 100, Primitiva 14s. 6d., ditto 5 p.ct. preference 51s. 3d., 51s. 6d., South Metropolitan 94⅛, 95, ditto 3 p.ct. debenture 60, 60⅜, North Middlesex 7½ p.ct. debenture 103½, 104, Uxbridge and Wycombe 5 p.ct. 85.

In the Money Market, with the turn of the new year, the position became extremely easy, and short loans were done as low as ½ p.ct. The situation intensified as the week went on, and supplies became hyperabundant, so that it almost became a matter of "no reasonable offer refused." Discount towered considerably under the influence of Treasury Bill rates. Silver fluctuated a good deal, according as the Eastern demand rose or fell, but was firm at the close. The Bank of England rate was 3 p.ct., as fixed on July 13.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S TRANSACTIONS.

Issue.	Share.	When ex-Dividend.	Ante-War Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices, July 30, 1914.	Present Prices.	Lowest and Highest Prices of Transactions.
£			p.c.					
182,049	Stk.	Aug. 24	4	4%	Aldershot 4 p.c. Pref.	..	68—73	...
1,351,868	,,	Oct. 5	4½	5%	Alliance & Dublin Ord.	59—64	62—67	64⅛
374,000	,,	July 13	4	4%	Do. 4 p.c. Deb.	76—79	60—65	...
280,000	5	Oct. 19	7½	4/-	Bombay, Ltd.	5⅞—6⅛	4⅛—5	90/-—92/6
100,000	5	Aug. 10	16	7½%	Bourne-mouth Gas and Water { 5 p.c.	..	11—12	...
383,110	10	,,	7	7%	{ B 7 p.c.	15—15½	11—12	...
115,000	10	,,	6	6%	{ Pref. 6 p.c.	13⅜—14	9—10	...
162,065	—	Dec. 29	—	4%	{ 4 p.c. Deb.	..	7⅛—76*	...
992,045	Stk.	July 27	14	61/-	Brentford A Consolid.	261—266	100—103	101—102
734,920	,,	,,	11	61/3	Do. B New	204—209	100—103	...
35,000	,,	,,	5	5%	Do. 5 p.c. Pref.	109—111	82—87	...
221,400	,,	Dec. 14	4	4%	Do. 4 p.c. Deb.	91—93	75—80	76
214,775	,,	Aug. 24	11	11½%	Brighton & Hove Orig.	208—213	165—170	...
244,200	,,	,,	8	8½%	Do. A Ord. Stk.	154—159	120—125	123—124
1,287,500	Stk.	July 28	5	5%	Bristol 5 p.c. max.	..	89—91	...
530,000	20	Oct. 5	12½	22/6	British	44—45	33—35	34⅛—35
10,000	10	Dec. 29	—	7/-	Do. 7 p.c. Pref.	..	9⅛—10⅛*	...
120,000	Stk.	June 29	4	4%	Do. 4 p.c. Deb. Stk.	88—90	75—80	...
245,771	,,	Dec. 29	4	4%	Buenos Aires 4 p.c. Deb.	85—87	53—58*	...
100,000	10	Nov. 2	—	—	Cape Town & Dis., Ltd.	1⅛—2⅛	6⅛—7⅛	...
100,000	10	Oct. 19	—	—	Do. 4½ p.c. Pref.	4—6	6—7	6⅛—7
100,000	Stk.	Dec. 29	4½	—	Do. 4½ p.c. Deb. Stk.	70—75	7⅛—76*	...
237,860	,,	,,	—	7½%	Cardiff 7½ p.c. Deb.	..	102—104*	...
157,150	,,	Feb. 26	5	5%	Chester 5 p.c. Ord.	108—110	..	...
1,513,280	,,	July 27	5/9/4	56/-	Commercial 4 p.c. Stk.	106—108	93—98	95—95½
560,000	,,	,,	5½	55/-	Do. 3½ p.c. do.	103—105	93—98	96
475,000	,,	Dec. 14	3	3%	Do. 3 p.c. Deb. Stk.	69½—71½	55—60	56
800,000	,,	Dec. 15	4	—	Continental Union, Ltd.	76—79	26—31	...
200,000	,,	Dec. 14	7	3%	Do. 7 p.c. Pref.	115—118	54—59	53—57
660,000		Sept. 1	—	6%	Croydon sliding scale.	..	96—101	99—101
284,975		,,	—	5%	Do. max div.	..	80—85	82½—83½
492,270	Stk.	—	6	4½%	Derby Con. Stk.	123—125	..	...
55,000	,,	—	4	4%	Do. Deb. Stk.	102—104	..	...
209,000	,,	Oct. 5	—	5%	East Hull 5 p.c. max.	..	..	...
2,002,180	10	July 13	10	5/0	European, Ltd.	17⅛—18	9⅛—10⅛	...
16,298,975	Stk.	July 27	4/17/4	52/-	{ 4 p.c. Ord	98—102	94—96	93⅛—94⅛
2,600,000	,,	,,	3½	35/-	Gas { 3½ p.c. max.	76—79	62—65	62⅛—63⅛
4,062,235	,,	,,	4	4%	Light { 4 p.c. Con. Pref.	96—99	76—81	77⅛—78⅛
4,674,850	,,	Dec. 14	3	3%	and { 3 p.c. Con. Deb.	72⅛—74⅛	59—62	60—60⅛
130,000	,,	Dec. 11	10	10%	Coke { 10 p.c. Bonds	..	..	...
—	—	—	—	—	{ 7½ p.c. Ilford Deb.	..	..	...
82,500	,,	Sept. 21	5	65/7½	Hastings & St. L. 5 p.c.	..	95—100	...
258,740	,,	,,	3½	50/7½	Do. 3½ p.c.	87—89	77—80	...
70,000	10	May 18	11	7½%	Hongkong & China, Ltd.	16½—16⅝	6—7	...
86,600	Stk.	Aug. 24	9	9½%	Hornsey 7 p.c.	..	127—132	130½—131
1,976,000	,,	Nov. 16	9	£5	Imperial Continental	150—160	157—162	159—161
404,800	,,	Aug. 10	3½	3½%	Do. 3½ p.c. Deb. Red.	84—86	77—82	80
235,242	,,	July 27	6½	6½%	Lea Bridge Ord. 5 p.c.	119—121	95—100	...
2,498,905	,,	Feb. 26	10	37/6	Liverpool 5 p.c. Ord.	..	..	...
620,010	,,	Sept. 21	—	7%	,, 7 p.c. Pref.	..	105—107	106⅞—106⅛
165,736	,,	Aug. 10	7/5/6	87/3	Maidstone 5 p.c.	..	87—92	...
63,480	,,	Dec. 29	—	3%	Do. 3 p.c. Deb	..	53—58*	...
75,000	5	June 29	6	6%	Malta & Mediterranean Met. of Melbourne } 4½ p.c. Deb.	4⅛—4⅜	3⅛—4	...
250,000	100	Oct. 2	4½	4½%		99—101	97—100	...
541,920	Stk.	Nov. 30	4	4%	Monte Video, Ltd.	11⅛—12	55—60	...
1,875,892	,,	July 27	4½	4½%	Newcastle & Gatsh'd Con.	98⅛—99⅛	75—80	...
98,125	,,	,,	—	4%	Do. 4 p.c. Pref. Stk.	..	66—69	...
529,705	,,	Dec. 29	3½	3½%	Do. 3½ p.c. Deb.	82—83	63—68*	...
15,000	10	Aug. 26	—	7/6	North Middlesex 10 p.c.	..	..	...
55,940	10	Aug. 24	7/14/0	7/8⅜	,, ,, 7 p.c.	14—15	10⅛—11⅛	...
300,000	Stk.	Nov. 30	8	8%	Oriental, Ltd.	117—122	95—100	98⅛—100
188,120	Stk.	Dec. 29	—	72/6	Plym'th & Stonh'se 5 p.c.	..	91—96*	...
60,000	50	Aug. 24	13	65/-	Portsea Island, B	128—131	100—105	...
100,000	50	,,	12	60/-	Do. C	118—121	85—90	...
249,980	5	—	8	—	Primitiva Ord.	5⅛—6	⅞—1⅛	13/4⅛—14/6
499,960	5	—	5	—	Do. 5 p.c. Pref.	4⅛—5	2⅛—2⅞	47/-—53/6
521,600	100	Nov. 30	4	4%	Do. 4 p.c. Deb.	91—93	68—73	...
600,000	Stk.	July 27	4	4%	Do. ,, ,, 1911	..	55—60	...
346,198	,,	Dec. 29	4	4%	River Plate 4 p.c. Deb.	85—87	53—58*	...
150,000	10	Sept. 21	6	6/-	San Paulo { 6 p.c. Pref.	10⅛—11	5⅛—6⅛	5⅛—5⅞
125,000	50	July 3	5	5%	{ 5 p.c. Deb.	47—49	35—38	36⅛—37
135,000	Stk.	Aug. 24	10	5%	Sheffield A	223—224	97—99	...
209,984	,,	,,	10	5%	Do. B	222—224	97—99	...
325,500	,,	,,	10	5%	Do. C	220—222	97—99	...
133,201	Stk.	Sept. 15	4	4%	Shrewsbury 5 p.c.	..	..	...
90,000	10	Nov. 2	9	7%	South African	10⅛—11⅛	7—9	...
6,609,895	Stk.	July 27	5/4/0	5%	South Met. Ord.	111—113	93⅛—95⅛	93⅜—95
250,000	,,	July 13	—	5%	Do. Red. Pref.	..	95—97	...
1,895,445	,,	,,	3	3%	Do. 3 p.c. Deb.	72⅛—74⅛	59—62	60—60⅛
734,000	,,	Sept. 7	—	6½%	Do. 6½ p.c. Deb.	..	105—107	105⅛
224,820	,,	Aug. 24	8½	8½%	South Shields Con. Stk.	157—159	108—110	...
1,087,795	,,	,,	6	6%	S'th Suburb'n Ord. 5 p.c.	114—116	97—100	99⅛—100
298,337	,,	Dec. 29	5	5%	Do. 5 p.c. Deb. Stk.	116—118	93—98*	95⅛
647,740	,,	Nov. 2	5	7%	Southampton Ord.	99—102	80—83	...
121,275	,,	Dec. 29	4	4%	Do. 4 p.c. Deb. Stk.	..	68—73*	...
250,000	,,	Aug. 24	—	21 8	Swansea 7 p.c. Pref. Stk.	..	103—105	...
100,000	,,	Dec. 29	—	20 2	Do. 6½ p.c. Deb. Stk.	..	101—103*	...
120,000	,,	July 27	—	7½%	Tottenham { A 5 p.c.	135—138	112—117	...
782,275	,,	,,	6	6%	{ B 3½ p.c.	115—117	100—103	101⅛
181,355	,,	Dec. 14	4	4%	District { 4 p.c. Deb.	87—89	75—80	...
236,476	Stk.	Aug. 24	5	2½%	Tynemouth 5 p.c. max.	108⅛—109	79—81	...
30,000	,,	July 27	8½	72/6	Wandsworth, Wimbledon, and Epsom—			
455,636	,,	,,	6½	57/6	Wandsworth A 5 p.c.	151—156	111—115	...
108,073	,,	,,	—	50/9	Do. B 3½ p.c.	129—134	95—100	...
140,865	,,	,,	—	50/9	Do. C.	..	87—92	...
352,000	,,	,,	6½	53/9	New Ordinary	..	87—92	...
98,000	,,	,,	6½	58/9	Wimbledon 5 p.c.	117—122	95—100	97
88,416	,,	Dec. 29	3	3%	Epsom 5 p.c.	121—126	95—100	...
					3 p.c Deb. Stk.	66—69	56—59*	...

* Ex Div.

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